

SPECIAL MEASUREMENT FINAL REPORT

SUBMITTED BY:

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EXECUTIVE SUMMARY

Special Measurement clothing represents a small but persistent part of the clothing demand by the US military services. For Army dress shirts, for instance, fewer than 0.2% of all shirts purchased each year are handled by the special measurement process. Although this quantity is small, it represents Service members who cannot be fitted by the stock sizes and have no alternative mechanism for obtaining uniforms.

Because of the styling and fit considerations, the problem is most often encountered with tailored or dress clothing items. This problem is a particularly difficult one for the Services' Recruit Induction Centers because of the limited amount of time between when the need for special measurement clothing is identified and the recruit's scheduled graduation date.

Prior to the closing of the DPSC factory, the factory manufactured the military clothing required for the unusually-shaped Serviceman or woman. After the closing of the factory, the problem was turned over to Government contractors.

Because of problems encountered by the Government contractors in handling special measurement orders, the DLA-sponsored Demo at Clemson Apparel Research was asked to manufacture dress shirts for the Army and Air Force. During this process the Demo was asked to devise more effective techniques for handling special measurement orders through manufacturing. The Demo was also required to document, in a quantitative manner, all times, procedures, costs, etc.

This report consists of the experiences of the Demo and the findings which have been made in over three years (from fall 1993 through spring 1997) as a part of the special measurement process. During this period, the Demo produced 6,000 shirts (plus an additional 1,000 shirts that were ordered under the special measurement process but were not truly special measurement garments).

The successes include: development of a workable procedure for deciding what size garment to produce for a particular order which uses the capabilities of state-of-the-art CAD systems, development of systems for flowing orders through pre-production, production, and post-production processes, and development of software (CARGOES) for use by a manufacturer for minimizing paperwork handling.

Issues which still need to be addressed include: developing a process for minimizing errors on order forms, developing procedures for automating the remaining steps for handling orders at the manufacturer, and finally minimizing the time for the entire process from initial placement of the order until receipt of a garment.

PROJECT OBJECTIVES

The objectives of this project include:

1. To determine the problems and potential solutions to the special measurement order handling process in effect in 1993.
2. To devise and implement a more effective order handling process in the Clemson Demo.
3. To develop techniques that can be transferred to Government clothing contractors.
4. To transfer the techniques to a Government contractor.
5. To document, quantitatively, all times, procedures, costs, etc. encountered in the special measurement process in the Demo.

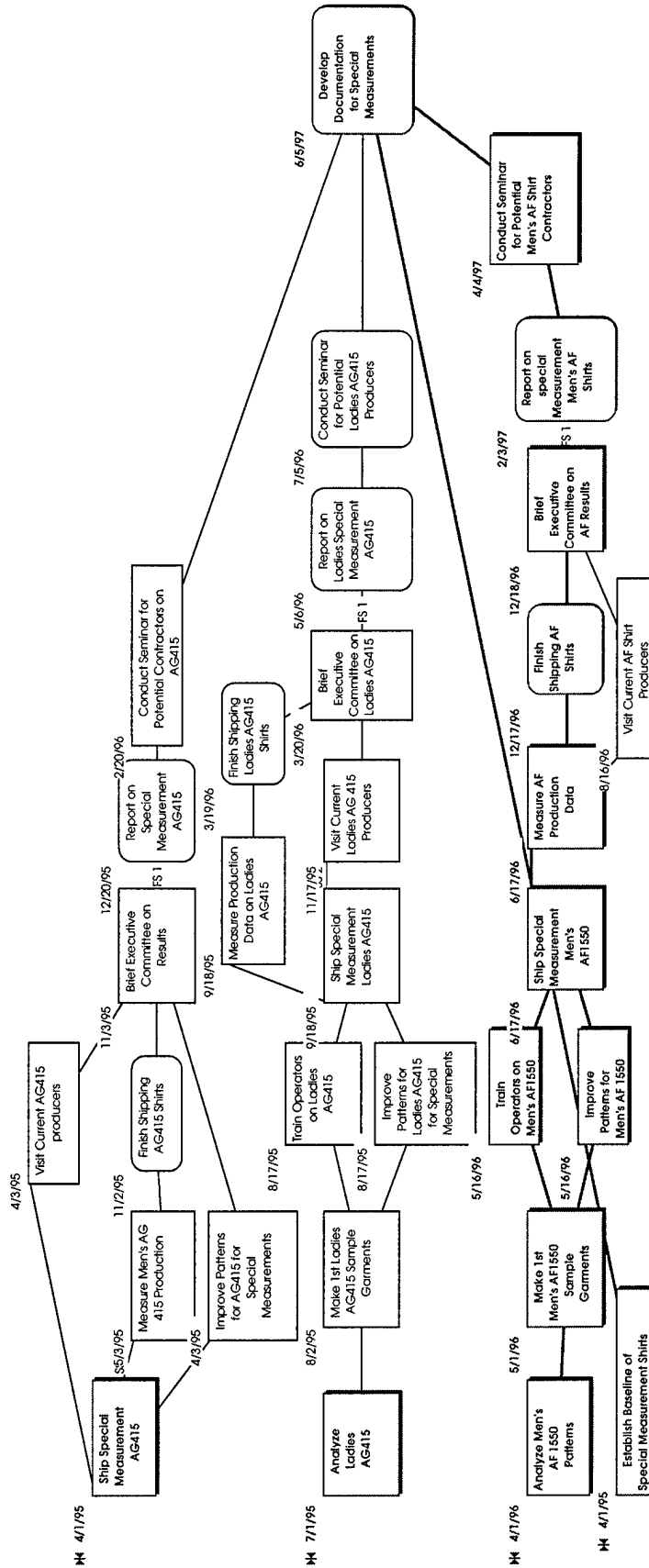
DELIVERABLES

Project deliverables include:

1. Special measurement shirts for the Army and the Air Force, made for individual orderers.
2. A procedure for handling special measurement orders at the Government clothing contractor (CARGOES).
3. Modified patterns for men's and women's Army AG415 dress shirts and women's Air Force AF1550 dress shirts.
4. A report on the activities of the Demo in special measurements.

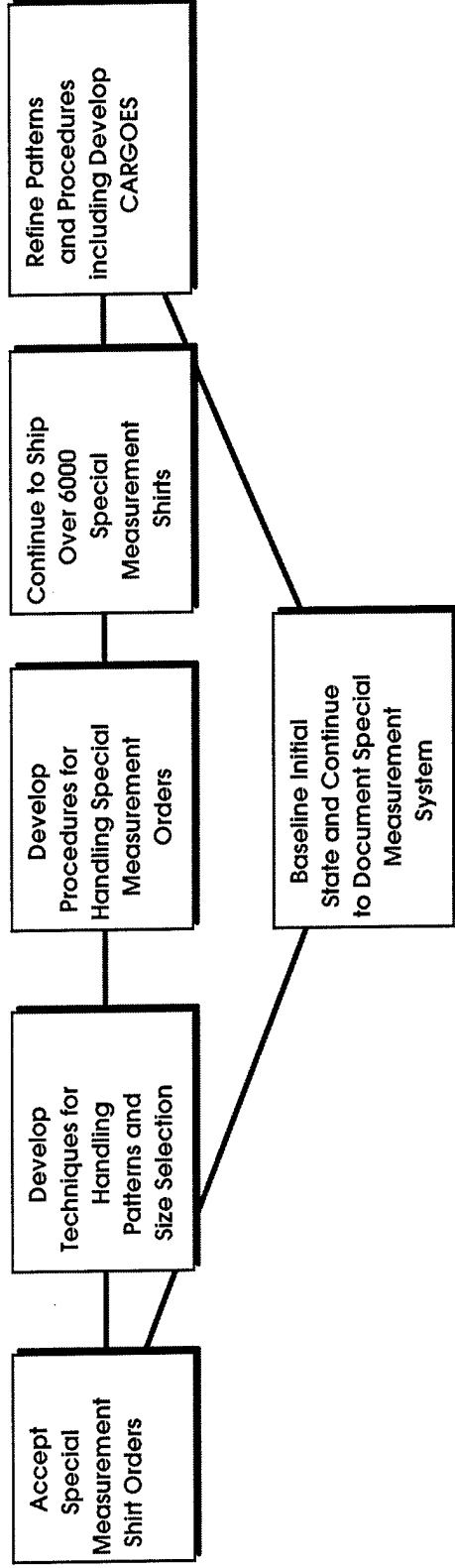
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CONTRACT PROFILE



ORIGINAL PROJECT SCHEDULE

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FINAL PROJECT SCHEDULE

The primary differences between the original schedule and the final schedule are:

- Ô Both the Army men's and women's special measurement AG 415 shirts were started at the same time during the demonstration.
- Ô The Air Force women's AF 1550 shirt was made by special measurement rather than the men's AF 1550. (A limited number of modifications were made for the men's AF 1550; these were supplied to the Government contractor prior to the start of this portion of the Demo contract.)

- Ô The style for both women's shirts changed, necessitating remaking patterns and procedures.
- Ô The software techniques originally envisioned had to be greatly enhanced.

The time frame for performing the project remained approximately the same as originally designed.

OVERVIEW

Special Measurement clothing represents a small but persistent part of the clothing demand by the US military services. Because of styling and fit considerations, the problem is most often encountered with tailored or dress clothing items.

Although the military clothing tariff or size distribution is supposed to fit approximately 95% of the military personnel, that is, only the very largest, smallest and unusually proportioned personnel should require special clothing, in practice only a very small percentage of dress clothing is ordered as special measurement items. For the Army men's dress shirts (AG415) only approximately 0.2% of the shirts are handled by the special measurement process.

Although this percentage sounds like a vanishingly small amount, it must be remembered that, unlike commercial clothing, the military person has no alternative source of clothing. There is no equivalent to a "Big and Tall shop" for the unusually tall soldier for instance. This individual is totally dependent upon the military clothing system to provide for his needs. (It should be noted that occasionally made to measure shirts which were produced in the Orient have been encountered. These shirts tend not to be in strict accordance with the actual military style and, of course, are not an option for most military personnel.)

Prior to the BRAC-mandated closure of the DPSC clothing factory, that facility handled all the special measurement clothing manufacturing. The factory received requisitions with the orderer's body dimensions, produced garment patterns, and manufactured the garments. Since no detailed records of the procedures used in the factory are available, it is not clear exactly how the orders were handled except that the requisitions did not have to go through contracting and patterns were made manually (rather than with a CAD system) by the "slip and slide" process. Reports from users of the system suggest that they considered the time required to receive garments as not unreasonably long and the garment quality as acceptable.

After it was clear that the factory was not going to be the process for manufacturing special measurement garments, DPSC sought another alternative. The production contracts of the commodity manufacturers of an item were modified to include the requirement to produce the corresponding special measurement garment. Manufacturers were offered a premium of 25% (over their commodity garment price) for this service, to cover primarily the additional fabric required for cutting a single unit. No pattern making skills would be required of the manufacturer; DPSC would continue to receive the special measurement orderer body dimensions and would supply patterns.

Immediately, there were protests from the government contractors. The nature of the protests ranged from a complete lack of capability to use the envisioned procedure to a feeling that the offered premium was far too low. The contractors commissioned an engineering study which suggested that a more fitting premium should be 400%. While this study did incorporate a number of non-optimal ways of handling these orders, it was useful in identifying problems which were encountered on the manufacturing floor in handling small orders in a commodity bundle environment.

A study subsequently conducted by CAR at one of the government contractors showed that the cost related to special measurement order handling was not particularly on the manufacturing floor. Orders there were handled with similar times to the commodity bundles; the significant costs were incurred in the pre- and post-production operations. Approximately 80% of the additional cost for special measurement orders were in these areas.

The additional time in the pre- and post-production operations is with hindsight easy to see. The same amount of paperwork was required for an order, regardless of size. So a single requisition for a special measurement garment required just as much paperwork as a requisition for a shipment of ten thousand units to a depot; the problem was the base for spreading out the cost of the paperwork was considerably smaller. In addition, the government-supplied paper patterns required appreciable handling. The patterns had to be hand cut and a manual marker made for cutting. Since the patterns did not include mirrored pieces (left and right fronts for instance; half backs were often supplied), the manufacturer had to make the rest of the pattern pieces. The paper patterns had all the manufacturing problems typically encountered with this technique: pieces that don't quite fit together, shapes that are not quite right, etc.

Even with all these problems most manufacturers were willing to take the contract modifications for special measurement garments if they had the corresponding commodity contract. They were interested in helping the government out of a problem and felt that their commodity contract would cover the increased cost, provided that the number of special measurement garments was not too large.

A particular problem was encountered with Army shirts. This item represents the largest number of special measurement orders. One of the contractors initially accepted the special measurement orders and then found that he could not handle them mixed with his commodity production operation. The backlog of shirt special measurement orders reportedly reached to approximately one thousand.

DEMO EXPERIENCES

In September 1993 Clemson Apparel Research was asked to assume responsibility for manufacturing the Army men's AG415 long and short sleeve special measurement shirts. At the time of this request, CAR had produced the Army men's short sleeve shirt on a demonstration basis for several years. In addition, CAR had some experience with relatively small commercial shirt production orders. CAR also had state-of-the-art apparel CAD systems and well-educated employees to operate them.

Even with this background, CAR found it was impossible to handle orders in the government-envisioned manner. Even at low volume, the paper patterns could not be managed. A more precise, systematic procedure would have to be devised.

The breakthrough for the production floor came when an examination of the body measurements for a large number of orders showed that there were many similarities in the orders. There were orders which needed larger shirts than in the stock tariff, orders which needed different combinations of neck and sleeve lengths than the stock tariff, orders from soldiers who needed extra body length, orders from soldiers who needed extra fabric in the waist, etc. These kinds of modifications could easily be handled by the functions built into an apparel CAD system.

CAR then decided to take advantage of all the tools available to an apparel manufacturer and to avoid making individual garments for individual orders in so far as possible. This premise underlies the entire special measurement effort at CAR: to take advantage of existing off-the-shelf technology where appropriate and to adapt this technology to commodity production of small numbers of units.

More detailed examination of the orders showed that they could be grouped into four general categories: stock, extended grade rule, pre-altered, and made-to-measure.

Stock: an order for a garment that could be filled from the existing DPSC tariff. In some cases, it was clear that the order originated from an ordering point that did not stock the entire tariff, in particular the ends of the tariff. Rather than ordering the garment through the existing requisition system, the orderer elected to place a special measurement order.

Extended grade rule: an order for a garment that was a simple extension of the existing grade rules for the garment. For instance, at the time that CAR became involved in special measurement Army shirts, the largest men's shirt size in the stock tariff was a 17.5 collar.

Orders for 18½s, 19.5½s, etc were extended grade items. There were also orders for different combinations of collar and sleeve lengths than existed within the stock tariff: a 17.5 collar with 40 inch sleeves for instance. Since these garments could easily be generated by extending the existing grade rules for growing sizes, CAR adopted the term extended grade rule to describe them.

Pre-altered: an order for a garment that requires a well-described, frequently encountered modification to the existing garment pattern. For instance, soldiers with long torsos require shirts with extra length, above and below the waist. Body builders require shirts with extra room in the biceps; frequently they also require fabric to be removed in the waist area.

Made-to-measure: an order for a garment that requires a garment be made for an individual.

In each case, the modifications and extensions were made in such a way that they could easily be accessed from the CAD system in all sizes. For instance, when the pre-altered patterns were built, a shirt with extra length could be available in any collar size from 12.5 to 24 and with any sleeve length from 29 to 41 inches. These capabilities are features of an effectively managed modern apparel CAD system. In general the modified or extended sizes could be just as easily available to the manufacturer as the standard garment patterns would be.

(This technique of pre-making patterns with particular, common modifications incorporated has also been used for Air Force men's dress coats for the Lackland RIC. The Haas Tailoring Company found that there was a significant need for dress coats with a more athletic build than the stock sizes. They built patterns and supplied coats with a larger drop than the stock sizes. The coats also incorporated larger seam allowances, to permit ready alteration. These coats, termed *blanks*, are supplied to Lackland in small quantities so recruits can be fitted quickly. The blanks are restocked on a quick turn. This process has eliminated the need for the majority of what formerly were special measurement coat orders.)

There are a few exceptions to the above statement. It was found that there were an appreciable number of soldiers who were best fitted with a shirt that had a collar on a shirt body of a different size, such as a 19 collar on an 18 shirt. Typically this arrangement seems to be required for someone who is or has been a body builder or someone who has a fleshier neck than typical. (The reverse combination of a smaller collar on a larger shirt is also ordered although to a lesser extent.) These pre-altered patterns are termed neck/body modifications.

Because of the large number of neck/body modifications that might be made, particularly on already altered bodies such as a 19 collar on an 18 body with 4 inches extra length added, the decision was made not to pre-make all the possible combinations. Instead, in such cases, the marker maker would call up the extra length size 18 body and a 19 collar and then "grow" the neckline of the 18 to where a 19 collar would fit. The same rules for generating the 19 neckline were used as would have been used for making a size 19 from the original patterns. The marker maker would then use the modified patterns for her marker.

This process requires a more skilled marker maker than if the decision had been to make and store all possible versions of all possible sizes. If the latter decision had been made however, the storage space and upfront skilled labor time would have been considerably greater. There clearly is a tradeoff however between the two different ways of approaching the solution. This point will be addressed later in more detail in the section on remaining issues.

Certain combinations of the neck/body were made however. In the case of the Army men's patterns, necks up to 2.5 inches larger (5 sizes) were built onto the standard body. An order for a size 19 body with a size 21.5 collar can be automatically generated. If the order needed a 19 body with 8 inches extra length and a 21.5 collar, then the marker maker would have to use the detailed procedure above.

It should be stressed that the different patterns are simply that: pattern options that are available for the manufacturer. The patterns become garments only when orders are received; there is no stock of multiply-modified garments sitting around in finished goods inventory waiting for an order from an appropriately sized soldier.

The development of patterns spans a period of approximately six months in the case of the Army men's shirt. As more orders for different bodies were received, it was seen that there was a general need for different patterns. The fit was also refined, based upon CAR's perception of how the professional fitters and drill sergeants at Ft. Jackson seemed to find garments acceptable on recruits. (In this case, fit is defined as the difference between the actual dimension of the garment and the corresponding body dimension of the soldier.)

The procedures for effectively handling orders also evolved. The original focus was on removing the backlog of shirt orders; the tracking of orders was secondary. Gradually more fields were added to an Excel spreadsheet to permit the tracking of more detail of the orders. The lack of complete

information on an order in the earliest months means, however, that although CAR started manufacturing Army men's shirts in October 1993, the database shows a start in early 1994.

In winter of 1993, CAR was asked to assume responsibility for manufacturing the Army women's AG415 shirts as well. This garment was a considerably more complex item than the men's shirts. At that time, the Army women's shirts were overblouses with darts in the fronts and backs. The patterns for the long and short sleeve shirts were different; the bodies nominally were the same except that the collars were different. The long sleeve shirt had a shaped collar that was three-dimensional.

These women's shirts represented a significantly different challenge in manufacturing for CAR. The automated equipment at CAR was selected for, and tooling made for, the Army men's shirt. It could not be readily adapted to the women's shirts, particularly not the three-dimensional sewing required for the collar. It was clear that manual operations were going to have to be more extensively used on the manufacturing floor.

The greatest problem was the assignment of the nominal size for the garment to each order. An analysis of the fitting of the women's shirt showed that a sequence of 17 steps would have to be followed in fitting the shirt to an order. In addition it was clear that there was more ambiguity in how the body measurement data sheets had been filled out by the orderers. There simply was not enough technical manpower available to handle the backlog of orders that came in if the same procedures which had been developed for the men's shirt were utilized.

The solution to the problem was to develop a decision support system to assist in the assignment of sizes. This decision support system was designed to take the ranges of dimensions that were deemed acceptable by the human size assigner, couple the ranges with a metric for determining the most economical fit, and then to come up with a suggested size with modifications for the human size assigner to start with. Any out of range measurements were flagged for further (human) review.

This procedure meant that the human size assigner started with a suggested size and then could refine the size assigned. Made-to-measure garments typically resulted when the assigned size would be too large in certain body dimensions and non-standard amounts of fabric would be removed.

Through 1996 the paperwork system consisted of a number of discrete elements. An Excel spreadsheet was used for recording contract information about individual requisitions, a series of small C programs were used for size assignment and then the results were pasted into the spreadsheet, a Word

document-the accompanying letter was linked to the spreadsheet, and a form for the DD250 shipping document/invoice was linked to the spreadsheet. As the spreadsheet grew larger and larger, it was clear that this cobbled together series of operations was stretched to its limit. An intensive series of sessions on process reengineering helped remove some of the bottlenecks and time-consuming parts of the operations but it was apparent that the spreadsheet had to be replaced with a more integrated solution.

The decision was made to replace the core spreadsheet with a true database. Because it was expected that the final software would be used by different contractors, a relatively inexpensive, readily available commercial product, Access, was selected. (This database would already have been in the possession of anyone who had purchased a bundled group of Microsoft office software for a PC; it would, however, leave the MacIntosh users out since Microsoft has never ported the product to the Mac.)

During the summer and fall of 1996, screens and forms for the new database were developed and tested. It should be appreciated that this change in software required that literally everything associated with the previous mode of operation had to be either ported or discarded.

DEVELOPMENT OF NEW SIZE RANGES AND PATTERNS FOR TUCK-IN STYLES

The situation was made more complicated by the change in garment style to a tuck-in women's shirt for both the Army and the Air Force. The garment change meant that new pattern modifications would have to be developed, based upon the new parts of garments that did not fit. New ranges of dimensions would have to be developed for the new patterns. And, CAR would have to develop a mechanism for translating fit comments about the old style garments into possible changes in the new style garments since orderers would be trying on the overblouses but then ordering tuck-ins.

In order to answer the question of how to map old and new style sizes across, CAR developed tables of actual pattern dimensions for the old and new styles. Based on these tables and assuming that the fitters would fit the woman's bust area the same way in the new style shirt, it appeared that the sizes would be displaced by two full sizes. That is, an old style 16 would be replaced by a new size 12 shirt. The results of the pattern dimension analyses can be seen in Table 1 (Appendix 1).

Examination of how the professional fitters at Ft. Jackson fit women's shirts showed that the displacement of sizes might not be this large. Since the fitters were not provided with any service guidance in how the new styles should be fit, they continued to fit the new shirts like the old style. That is, the fitters first fit the recruit's cross shoulder and then check the bust area fit. Since the relationship between the cross shoulder and bust dimensions is

different on the new shirt, the fitters would often find that they needed to supply a one size larger garment than the cross shoulder width would indicate in order to accommodate the front fullness of the bust. The net effect of these changes was that, although the bust dimensions would suggest that the new shirts should be issued two sizes smaller than the old shirts, typically one size smaller shirt was issued in the new style compared to the old style.

The results of actual fits to recruits during the time that both the old and new style shirts (in long and short sleeves) were being issued during the fall of 1996 can be seen in Chart 1. This chart shows the relationship between the sizes of shirts issued to the same recruit. Because of the uneven exhaustion of inventory of short sleeve versus long sleeve shirts, typically a recruit would be issued an old style short sleeve shirt and a new style long sleeve shirt. When the remaining inventory of sizes of the short sleeve shirt reached a low level, Ft. Jackson stopped issuing the old style shirt so that a recruit training class could be outfitted in the same style.

This chart is read vertically. A vertical slice through the two lines on the chart shows both the size of the old style shirt and the size of the new style shirt issued to the same recruit. For the 109 recruits examined, it can be seen that the typical offset between the sizes is one whole size; for instance, a recruit might be issued an old size 18 and a new size 16 shirt. In some cases the offset was greater; for instance, the chart shows that some recruits who were issued old size 12 were issued new size 10, 8 or even 6. It is clear that very few women were issued the same numerical size in the new style as in the old style.

Size Differences in 109 Mixed-Style Army Women's Shirt Orders

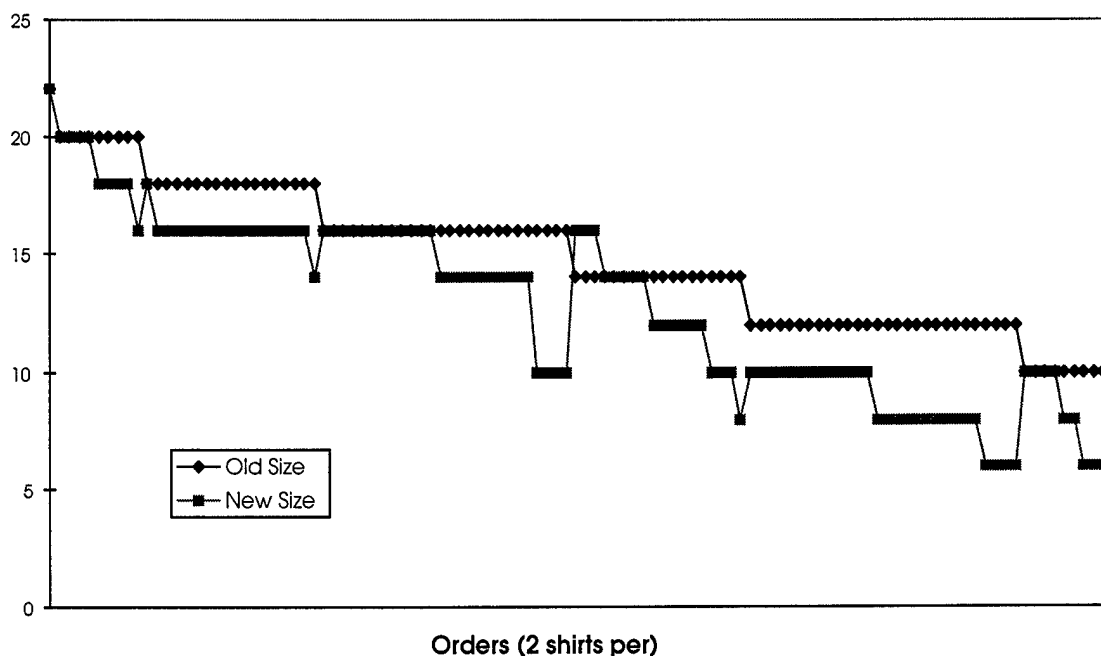


CHART 1: SIZE DIFFERENCES IN 109 MIXED STYLE ARMY WOMEN'S SHIRT ORDERS

This analysis was also useful in identifying a potential problem with sleeve length on the new style long sleeve shirt. Customers of the old style shirt had commented previously that the sleeve lengths were too long; the new style sleeve did result in shorter long sleeves in general. However, there were always an appreciable number of the longest sleeve lengths issued. Since in at least some cases, the customer had a choice of the sleeve length and presumably deliberately chose the longer sleeve length, it must be assumed that these customers had a reason for needing the longer sleeve length.

The potential demand for longer sleeves is significant. If the accumulated typical annual demand for shirts which differ in sleeve lengths by more than 1/2 inch is tabulated, then it appears that approximately 4,000 shirts per year could not be issued in the new style. These shirts would have to be ordered by the special measurement process.

The demand that materialized through March 1997 was 270 shirts for additional sleeve length only. Through September 1997 the demand was for 800 shirts, primarily for the RICs at Ft. Jackson and Ft. Leonard Wood. The cutoff date of September was selected because at that time, shirts with increased sleeve lengths were becoming available as extensions to the DPSC

stock tariff. So the entire demand had not materialized (perhaps because of a delayed changeover to the new style shirt by soldiers who could not find the proper sleeve length), but an appreciable part did.

During the first quarter of 1997 CAR switched over to using the Access database for all orders. The Army men's shirt size assignments were switched immediately while the women's size assignments were not rewritten until later. The combination of a new women's shirt style and the need to develop experience with what pattern modifications would be needed led to the delay. The database is written in modular format so that adding new garments and their ranges for dimensions is considerably easier than it would have been under the old spreadsheet system.

In the winter of 1995 CAR was asked to assume responsibility for the Air Force women's dress shirt AF1550 when the contractor decided to exit from making AF special measurement shirts. So when CAR began producing the shirt, it was the old style, also an overblouse, and later shifted to a similar tuck-in to the new style Army shirt.

FIT RULES USED FOR SPECIAL MEASUREMENT SHIRTS

The fit rules used in deciding how much difference there should be between the orderer's measurements and the actual finished shirt dimensions have continuously evolved. The original rules were developed from fitting the military garments to civilians; later the rules were refined by observing the professional fitters at Ft. Jackson as they fitted Army recruits with their dress clothing. Still further refinement of some of the multiply-modified patterns resulted from conversations with commercial manufacturers with similar, quasi-military customers.

In general, the fitters at Ft. Jackson tend to fit the garment on the cross-shoulder first, then check the collar and chest/bust. The waist and hip/sweep are checked to see if there is sufficient room; rarely are alterations requested for a shirt with excess material in the lower portion of the shirt. Finally, the sleeves are checked for sufficient room in the bicep area and correct length.

The fitters appear to prefer a somewhat slimmer fit than is current civilian fashion, with its oversized, off-the-shoulder appearance.

The following rules are used in deciding what size garment to supply for a particular set of orderer measurements:

For Men's Army AG 415 shirts:

Collar: Requested collar size. If neck measurement is supplied, then actual buttoned collar measurement is 0.5 inches larger than neck.

Chest: Shirt supplied measures 7 to 10 inches larger than orderer's measurement.

Waist: Shirt supplied measures 5 to 10 inches larger than orderer's measurement.

Bicep: Shirt supplied measures at least one inch larger than orderer's measurement.

Sleeve length: Shirt supplied measures at least one inch longer than orderer's measurement. (Sleeve lengths are only supplied in one inch increments.)

Cross-shoulder measurements tend to be unreliable measurements. They are used to generate wide-shoulder variations only when a specific note about the soldier's shoulder width is given.

Length measurements tend to be unreliable. Therefore, a rule for adding length to the tail of the shirt based on the soldier's height is used: 6 feet 2 inches, add 2 inches; 6 feet 5 inches, add 4 inches; 6 feet 8 inches, add 6 inches; 7 feet, add 8 inches. This somewhat generous rule is used because the extra length can readily be removed at most ordering points if necessary.

For Women's Army AG 415 and AF 1550 tuck-in shirts:

Neck: Shirt supplied measures at least 0.5 and preferably 0.75 inches larger than supplied measurement.

Bust: Shirt supplied measures at least 6 inches larger than supplied measurement. If a full bust is indicated, then a plus bust option (which adds an additional 2 inches in the front bust area) is supplied.

Waist: Shirt supplied measures at least 5 inches larger than supplied measurement.

Sweep: Shirt supplied measures at least 4 inches larger than supplied measurement.

Bicep: Shirt supplied measures at least 2 inches larger than the supplied measurement.

Sleeve length: Shirt supplied measures at least one inch longer than supplied measurement. (Measurement is made from center back at base of neck, around bent elbow to the wrist, just like a man's shirt measurement.)

Back waist length measurements tend to be unreliable. It is not unusual to receive an order where it is clear that the person making the measurements measured to the bottom of the tail of the shirt, rather than to the soldier's waist. These kinds of problems are easily recognized because the total height dimensions add to more than the orderer's height. Unfortunately, recognizing the problem does not help when trying to decide if extra length needs to be added to a shirt for a 6 feet 1 inch soldier.

It is clear that better, more reliable measurements are needed for these orders. Frequently the size assigner is left to guess at how reliable a particular measurement is, based on experience with body dimensions and anthropometric tables. This topic is discussed in more depth later.

RESULTS OF DEMO EXPERIENCES

The tables below summarize the data collected in over three years of manufacturing special measurement shirts for the Army and Air Force. Please note that there are frequently two sets of tables for the women's shirts representing the old and new style garments for both the Army and the Air Force. (old style=overblouse; new style=tuck-in)

For every table, Quantity refers to the number of shirts, not orders for shirts. For the Army men, the mean number of shirts per order was 1.5; for the Army women, 1.3; for the Air Force women, 2.4. The overall mean is 1.6 shirts/order. The reason for the higher number of shirts per order for the Air Force is the large portion of the orders from the RIC at Lackland AFB; the RIC issues three long sleeve and three short sleeve shirts per recruit.

The charts which correspond to these tables can be found in Appendix 2 for the Army men, Appendix 3 for the Army women, and Appendix 4 for the Air Force women. The Appendices amplify the meaning of the different modifications required to fit particular orderers.

Table 2 shows the overall breakdown of each style garment into the general categories of stock, extended grade rule, pre-altered pattern, and made-to-measure.

These tables permit DPSC to decide whether it makes more sense to continue to treat a Service person with a particular group of body measurements as a special measurement order or if they should add a shirt that would fit that Service person to the stock tariff. The tables show exactly what the demand for particular sizes has been and is likely to be in the near term. This demand can be multiplied by the special measurement process cost and compared to the expense of adding small volume NSNs (and the accompanying cost of pulling small requisitions from the depot).

Number of Shirts by Type and Alteration

	Extended Grade	Pre-Altered	Made To Measure	Stock
Army Women's Old Style	970	531	44	35
Army Women's New Style	119	311	6	22
Air Force Women's Old	370	657	140	52
Air Force Women's New	19	122	22	21
Army Men's Shirts	601	807	39	112

Ratio of Alterations by Shirt Type

	Extended Grade	Pre-Altered	Made To Measure	Stock
Army Women's Old Style	0.61	0.34	0.03	0.02
Army Women's New Style	0.26	0.68	0.01	0.05
Air Force Women's Old	0.30	0.54	0.11	0.04
Air Force Women's New	0.10	0.66	0.12	0.11
Army Men's Shirts	0.39	0.52	0.03	0.07

TABLE 2 NUMBER OF SHIRTS BY TYPE AND MODIFICATION

It can be seen that there is a small but persistent problem (roughly 5-7%) of stock shirts being ordered as special measurement garments. From the beginning the decision was made that these garments would be manufactured as specials rather than sending the orders back through the system. It was felt that sending the orders back would significantly add to the amount of time required before the orderer received his/her garment.

In general there were few made-to-measure shirts required. It is not known, of course, how many of the shirts shipped underwent further modification at a facility with alteration resources such as an MCSS.

The distribution of types of modifications (extended grade rule, pre-altered) varies greatly by the garment type. A more detailed examination of the types of modifications is revealing. It should be noted that every modification is counted; that is, a shirt that required both extra length and extra room in the bicep area would show as both extra length and bicep. The charts represent total modifications required, not total pre-altered shirts required.

Number of Shirts by Size and Alteration For
Army Men's Shirts

	Stock	Made to Measure	Pre-Altered	Extended Grade
12.5	0	0	1	0
13	0	0	0	3
13.5	0	0	0	0
14	0	0	0	0
14.5	0	0	1	0
15	0	5	10	0
15.5	0	0	16	0
16	1	2	23	1
16.5	5	2	38	0
17	9	0	48	4
17.5	12	6	84	86
18	85	6	135	84
18.5	0	13	160	154
19	0	0	126	137
19.5	0	2	55	59
20	0	1	71	50
20.5	0	0	5	7
21	0	0	30	9
21.5	0	2	5	2
22	0	0	0	3
22.5	0	0	1	1
23	0	0	0	1
Totals:	112	39	809	601

Number of Alterations

2"	4"	6"	8"	M	P	XX	PP	PW	WB	B	Neck-Body
123	228	145	46	33	23	26	9	3	2	45	167

TABLE 3 ARMY MEN'S AG415 SHIRT: SIZES AND ALTERATIONS
(Army Men's Data: 2/94 to 12/96)

It should be noted that a large portion of the special measurement distribution of nominal sizes for the Army men is a simple extension of the existing stock tariff (which terminated at 17.5 and then 18 for the bulk of the time that this study covers).

Number of Shirts by Size and Alteration For
Army Women's Old Style Shirts

	Stock	Made to Measure	Pre-Altered	Extended Grade
6	1	0	0	0
8	0	0	0	0
10	0	0	0	0
12	0	0	0	0
14	0	0	2	0
16	3	1	10	0
18	5	4	8	0
20	26	5	43	0
22	0	7	89	121
24	0	11	116	249
26	0	10	121	283
28	0	1	58	174
30	0	2	55	98
32	0	1	21	25
34	0	2	6	17
36	0	0	2	3
TOTALS:	35	44	531	970

Number of Alterations

PB	MB	PW	PH	PWH	WB	XWB	B
191	37	94	89	60	81	0	3

TABLE 4 ARMY OLD STYLE WOMEN'S AG415 SHIRT: SIZES AND ALTERATIONS
(Army Women's Data:3/94 to 12/96)

The special measurement distribution of nominal sizes of the old style shirt for the Army women is clearly an extension of the stock plus an additional peak to larger sizes. That is, for the women, there are a few soldiers who were left out of the stock tariff (as in the case of the men) but there is also a group which is significantly larger. These larger sizes are almost exclusively ordered for JROTC.

For the old style Army women's AG 415 shirt, the largest stock size was a 20. Although the short sleeve shirt came in four proportional lengths, the long sleeve did not come in the longest body length. It can be seen from the chart that a large portion of the special measurement shirts were extended grade rule. These shirts were produced with either the additional body length which was needed by longer torso women or simply larger sizes.

The problem of larger sizes was addressed when the initial stockage was made on the new style women's shirt. The new style was stocked in

additional sizes 22, 24, and 26. With the additional size from the style shift, effectively four sizes were added to the large end of the stock tariff. This tariff change has led to a greatly diminished need for extended grade shirts.

Number of Shirts by Size and Alteration For
Army Women's New Style Shirts

	Stock	Made to Measure	Pre-Altered	Extended Grade
10	0	0	0	0
12	0	0	32	2
14	1	0	48	1
16	4	0	62	8
18	10	0	59	6
20	2	1	56	9
22	4	1	11	32
24	1	0	2	32
26	0	3	10	27
28	0	0	1	1
30	0	0	0	0
32	0	0	2	0
34	0	0	1	1
36	0	1	0	0
TOTALS:	22	6	284	119

Number of Alterations

	Sleeve	Bicep	Neck-Body	Waist	Sweep
Addition	270	26	31	5	2
Removal	0	0	0	0	1

TABLE 5 NEW STYLE ARMY WOMEN'S AG415 SHIRT: SIZES AND ALTERATIONS

The new style shirt did create a new fit problem: small collars for the larger size shirts. The new shirt has a 1/4 inch grade increment between sizes; that is, the collar of a 16 is 1/4 inch longer than that of a 14, and so on. The effect of this grade is that the larger shirts have collars that tend to be too small (and the smaller sizes have collars that tend to be too large). It should be noted that the commercial grade for a similar style shirt would be 1/2 inch. This grade for the new style shirt is the same as for the old style shirt but the neck on the old style is both larger in general and shaped differently for the old short sleeve shirt. The net result is an increase in the number of neck/body combinations needed for the large shirts.

The new shirt also appears to have too small a bicep area for the larger sizes. Up to seven inches additional space has been needed in the bicep area. This

large an addition has necessitated building two new shirts. Changes were required in the front and back of the shirt as well as the bicep of the sleeve for these major additions.

Number of Shirts by Style and Alteration For
Air Force Women's Old Style Shirts

	Stock	Made to Measure	Pre-Altered	Extended Grade
10	0	0	3	0
12	0	0	27	6
14	9	9	180	14
16	21	17	161	22
18	14	14	137	8
20	8	25	32	18
22	0	16	42	31
24	0	5	10	49
26	0	6	7	48
28	0	9	19	70
30	0	14	19	60
32	0	8	5	18
34	0	7	12	13
36	0	9	1	5
38	0	1	1	6
40	0	0	1	0
Totals:	52	140	657	368

Number of Alterations

L	M	W	WB	B
557	8	8	1	9

TABLE 6 OLD STYLE AIR FORCE WOMEN'S AF1550 SHIRT: SIZES AND ALTERATIONS

(Air Force Women's Data: 10/95 to 12/96)

Number of Shirts by Size and Alteration For
Air Force Women's New Style Shirts

	Stock	Made to Measure	Pre-Altered	Extended Grade
10	0	0	0	0
12	3	3	0	0
14	0	3	0	2
16	0	0	17	0
18	3	2	11	0
20	3	5	9	2
22	4	0	13	2
24	2	8	21	9
26	6	0	31	1
28	0	1	8	1
30	0	0	5	2
32	0	0	3	0
34	0	0	4	0
36	0	0	0	0
38	0	0	0	0
40	0	0	0	0
Totals:	21	22	122	19

Number of Alterations

	Waist	Sweep	Biceps	Neck-Body
Addition	16	12	43	82
Subtraction	5	4	0	0

TABLE 7 NEW STYLE AIR FORCE WOMEN'S AF1550 SHIRT: SIZES AND ALTERATIONS

The old style Air Force women's AF1550 shirt was almost exclusively ordered as a special measurement item by the Lackland RIC because the long sleeves were too short. Typically an order would be for three long sleeve shirts with two inches of additional sleeve length. Lackland never ordered short sleeve shirts. The new style AF1550, although similar to the AG415, has different grade increments on the long sleeves. As a result, the longest long sleeve for the Air Force is appreciably longer than the longest long sleeve for the Army. No special measurement orders for the new Air Force shirt have been received for sleeve length. (It is possible that there are some orders for additional sleeve length; Lackland's special measurement shirt orders are now being filled by a different manufacturer under their prime vendor contract.)

In contrast, the major reason for special measurement orders for the new Army women's shirt are for additional sleeve length. A total of 126 orders for 545 additional sleeve length shirts have been processed from late fall 1996 through May 1997. The two Army CIIPs that process women, Ft. Leonard Wood and Ft. Jackson, began to order extra sleeve length in multiples. That is, they would send quantity orders for 16L with 1.5 inches additional sleeve length. Sufficient orders for extra sleeve length have forced the clothing system to add extra NSNs and to add these items to the stock tariff. (It is anticipated that the extra sleeve length shirts will be generally available as stock items during the fall of 1997. CAR's experience with the quantities ordered by the CIIPs by size has helped set the levels for the initial stockage.)

The new style Air Force women's shirt also has a similar problem with the grade increment for the collar, which results in a need for neck-body combinations in the larger sizes. This problem is perhaps magnified by body measurement errors by the orderers; some of the neck circumferences reported seem implausible. No shirts were ever sent back because the orderer felt that the collars were too large (although there was a simple mechanism for so doing).

For both services for women's shirts, the large size shirts were generally ordered by the JROTC units. This situation did not carryover to the Army men's shirt however; for this garment, the large sizes were ordered by both JROTC and regular army personnel. This ordering pattern probably reflects both that height/weight standards are adhered to by the recruits but not the JROTC programs and that there are many more older men in the military than older (more likely to be heavier) women.

The distribution of orders by origin is shown in Table 8. From this table it can be seen that the six Army CIIPs originated a small portion of the orders (<20%). The bulk of the Army women's shirt orders originated approximately half from JROTC and the remaining one-third from MCSS. For the Army men, the percentages were reversed; half of the orders originated from MCSS and one-third from JROTC. Since the JROTC units in the Air Force order through the MCSS, in general it is not possible to reliably separate AFJROTC from MCSS orders. It was noted that very few orders for special measurement shirts originated from Lackland except for the old style Air Force women's long sleeve shirt. It should also be noted that virtually no Army women's special measurement shirt orders originated from the CIIPs until the sleeve length problem was encountered with the new style long sleeve shirt.

	CIIP	MCSS	ROTC
Army Women's	247 orders (19%)	371 orders (28%)	717 orders (54%)
Army Men's	173 orders (14%)	669 orders (54%)	388 orders (32%)

TABLE 8: ORDER ORIGIN FOR ARMY MEN'S AND WOMEN'S SPECIAL MEASUREMENT SHIRTS

(CIIP: Clothing Initial Issue Point, shirts ordered for recruits; MCSS: Military Clothing Sales Stores, shirts for active duty soldiers; ROTC: Junior and Senior ROTC, virtually all orders came from high school units)

(Please note that Table 8 refers to number of orders, not number of shirts.)

For orders received from Army CIIPs, a total of three men's and seven women's were for true made-to-measure shirts. The remainder were for pre-altered and extended grade rule shirts.

For all three groups, Army men and women and Air Force women, there has been a steady decline in the number of special measurement shirt orders. This decline can be attributed to a number of factors. First, for all three garments, the stock tariff has been dramatically revised to include many more larger sizes. Second, the women's shirt has been restyled from a fitted overblouse to a much looser tuck-in; this styling change has greatly expanded the range of differences in dimensions between the wearer's body and the shirt which still result in an acceptable fit. Third, there has been a dramatic decrease in the number of orders from JROTC units. It is unknown whether this change is connected with the delays these units experienced in receiving their appropriated funds or if there is some other controlling factor.

The time required for each part of the system to process its part of an order is shown in Charts 18-20. The times are divided into three major sections: time from order origin to receipt of the order at the manufacturer (CAR), time from receipt at manufacturer until the shirt was shipped, and time from shipping until the manufacturer received payment from the Government. The shaded sections for this latter activity on the Army men's and women's charts reflect that these garments were moved onto the CAR demo contract and thus no additional payment was received for these garments. The time shaded is the corresponding payment time for the Air Force women's shirts which were always handled as small purchase contracts with a fast payment option.

Special Measurement Shirt Order Procedural Time Lines

Average Days Between Events : Drawn to Scale

Army Men

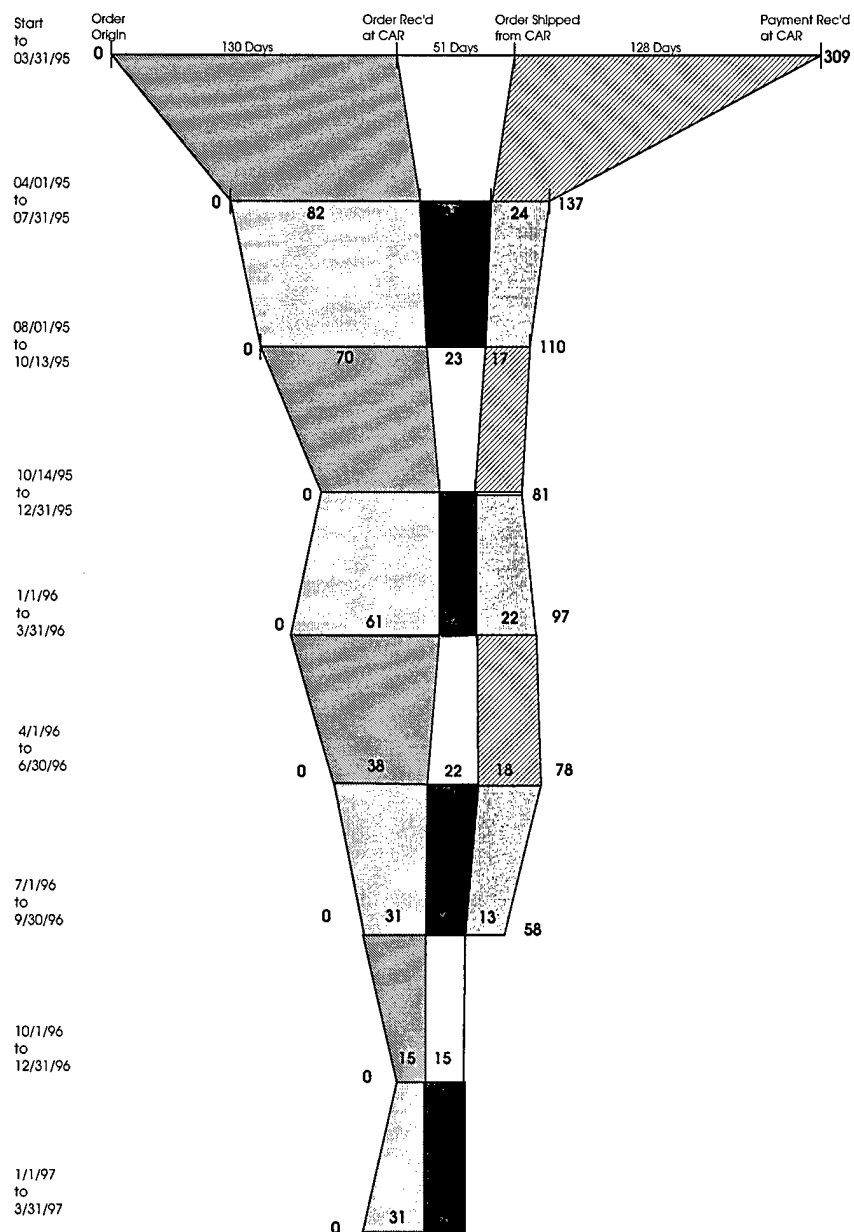


CHART 17: TIME LINE FOR SPECIAL MEASUREMENT ARMY MEN'S AG415 SHIRTS

Special Measurement Shirt Order Procedural Time Lines

Average Days Between Events : Drawn to Scale

Army Women

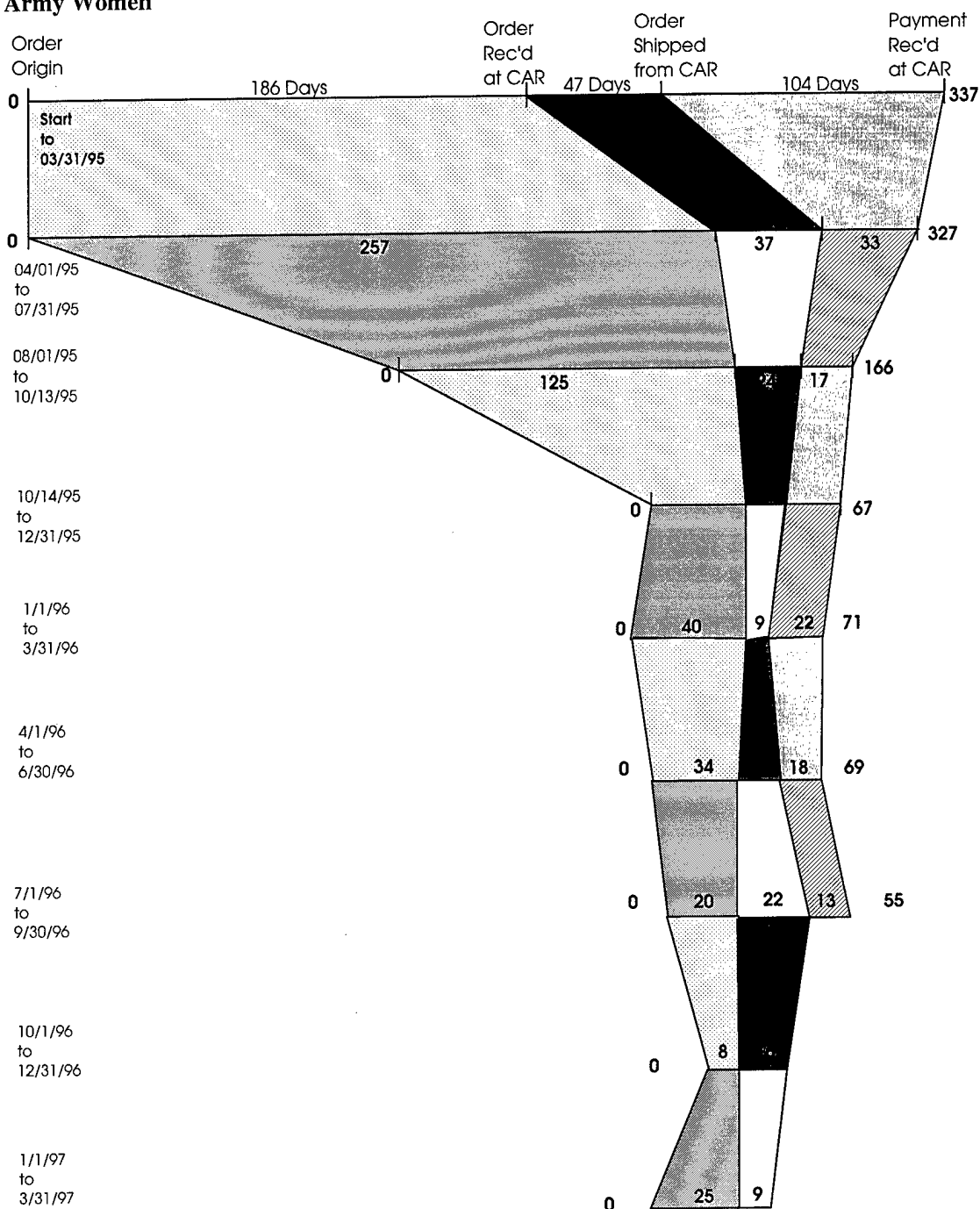


CHART 18: TIME LINE FOR SPECIAL MEASUREMENT ARMY WOMEN'S AG415 SHIRTS

Special Measurement Shirt Order Procedural Time Lines

Average Days Between Events : Drawn to Scale

Air Force Women

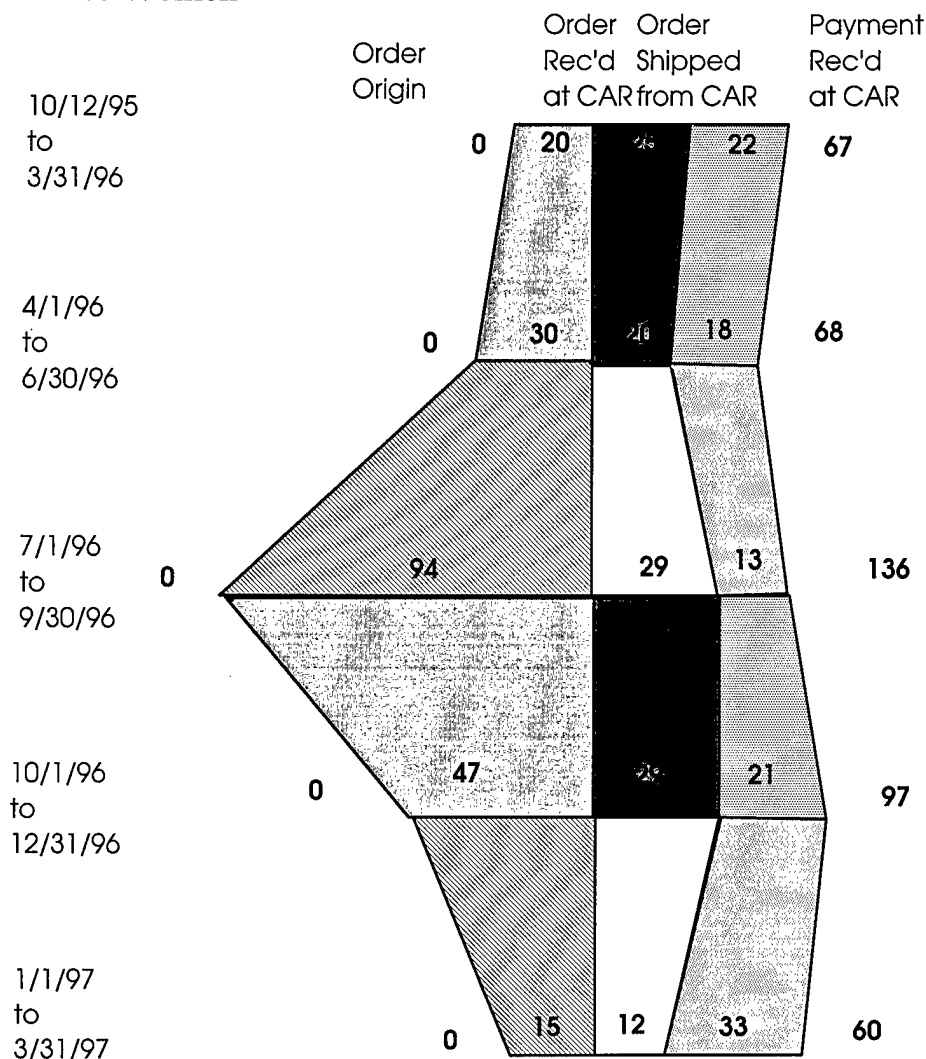


CHART 19: TIME LINE FOR SPECIAL MEASUREMENT AIR FORCE WOMEN'S AF1550 SHIRTS

Time lines represent the average number of days required for each step to be completed in a 90-day period. Outlier data have been removed; that is, any data point more than three standard deviations from the mean is not included in the time lines. This step was taken to keep truly abnormal orders from biasing the results. It should also be noted that the time at the manufacturer includes time required to rectify problem orders or orders with conflicting, misleading or missing information. Although rectifying these problems is clearly not the responsibility of the manufacturer and thus

should not count against manufacturing time, no satisfactory way of handling these data points was ever found.

The initial long times reflect the backlog of shirts which had built up in the system before CAR began to manufacture the special measurement shirts. After the backlog was removed, then all parts of the system began to function more effectively and the processing times dropped significantly.

It should be noted, however, that the processing times are still unacceptably long. For the most part all the steps operate in series, not parallel, so it still takes nearly two months to totally process a special measurement order. Since a recruit graduates from initial training within three weeks of time that the shirt order is placed, this means that the special measurement shirt can still miss the recruit at his/her first station.

An attempt was made to cut down on this time by permitting the pre-manufacturer and manufacturer times to run in parallel. It was possible for the Ft. Jackson CIIP to fax an order to CAR at the same time that the same order was faxed to DPSC. Ft. Jackson could manually obtain a requisition number for the DD250 and shipping documents could be generated. This procedure worked only for garments for which CAR essentially had a long-term contract, the Army shirts under the Demo contract. The Air Force CIIP orders were still processed at small purchase contracts so the pre-manufacturer and manufacturer operations continued to run in series.

Long term improvement in the times at the manufacturer depends upon the resolution of several problems which are discussed in more detail in the next section.

Over the six month period from the end of 1996 through the beginning of 1997, direct costs of handling special measurement shirts were tracked. Actual cost of labor was calculated from timesheets that tracked with each block of shirts. The cost of all labor, from initial order receipt through size assignment through marker making through sewing through shipping, were calculated from the minutes required for each operation and multiplied by the actual cost of each person's time. Since the groups of labor in some cases are considerably higher paid than the corresponding industry category (sizes were routinely checked or assigned by a PhD scientist for instance), this process inflates the cost that industry would incur. The direct labor cost includes fringe benefits.

No indirect labor costs are included.

Because of the disparity in salaries for personnel who might be expected to perform different operations is significant versus the industry, it was felt that

a listing of operation times might be more useful. For a typical month's orders for 62 shirts (on a per shirt basis) order entry (receipt of order package by FedEx and entry of contract and individual orderer procurement information) required 0.71 minutes, size input (entry of orderer measurements, size decision including manual checking, and re-input of any changed garment orders) required 2.2 minutes, pre-production (scheduling of cut and bundle, assignment to marker, marker making, and cutting) required 13.2 minutes, and post-production (receive shirts from production, verify against order, close container, prepare shipping documents, and ship) required 4.9 minutes.

The cost of fabric represents the cost of fabric which was typically required for a shirt in a one garment marker (2 yards). This cost is higher than would be encountered for the commodity manufacturing of the same item since the one shirt marker necessarily has appreciably lower fabric utilization than would a multiple shirt marker plus in general these shirts are much larger than the stock tariff items.

Shipping costs are the typical cost of shipping one garment by UPS ground (3 day service) to a US destination. Multiple unit shipments and speedier delivery would also be somewhat higher. (Although on a per shirt basis, multiple shipments are less expensive.)

No overhead costs are included. For Clemson University, these costs would be 46% on an on-campus research project. Since the components of a university overhead rate are so different than a manufacturer would include, it was felt that any potential manufacturer should use his own rates.

These typical costs are summarized in Table 9.

Direct Labor	\$9.29
Fabric (2 yd@\$2.50/yd)	5.00
Findings	0.325
Shipping	3.31
Total	\$17.925

TABLE 9: AVERAGE COST TO PRODUCE A SPECIAL MEASUREMENT SHIRT
(EIGHT MONTH AVERAGE)

Customer feedback of satisfaction with the process has been difficult to obtain. For approximately two years, every shirt made in the Demo has had a customer comment card attached; each shipment has been accompanied by a letter that asks that the card be filled out and returned. The letter also states

that if there is anything wrong with the shirt, to please return it with comments to CAR and it will be replaced.

The comment card is a post-paid postcard with three questions and space for additional comments. The questions are: How well did your shirt fit? (excellent, above average, average, poor), Are you pleased with the quality of the shirt? (yes, no), and Were your shirts delivered in a timely manner? (yes, no) with space for explaining *ÎnosÎ*. It was felt that this brief, easy to use card was more likely to be filled out than a more complicated form. Despite this design only a minimal number (<5%) of cards were returned.

Comments are mixed. Some customers liked the fit; others did not. When the fit questions were traced to the original DD1111 and DD358 forms, it was generally found that the orderer could not possibly have the dimensions on the form from the comments received.

Customers were generally pleased with the quality of the shirts.

Responses to the timeliness question were interesting; they clearly had to be interpreted as how happy the orderer was with the entire ordering cycle, not just the portion at the manufacturer. For instance, one orderer felt that the process had taken far too long but the order had been received at the Demo and shipped fewer than eleven days later. Inspection of the entire requisition showed that it had originated twenty-two days prior so the entire process had taken a total of thirty-three days. In other cases it was clear that there was a major disconnect between when the orderer felt that the process had started and when the requisition number showed that the process had started. Regardless of where the problem occurred, there are still an appreciable number of special measurement customers who feel that the process takes too long.

REMAINING CONSIDERATIONS

The process of improving the handling of special measurement orders is not finished. Areas which still need to be addressed more effectively include: stock shirts ordered as special measurement garments, decreasing the amount of time from order origin to shipping, decreasing the number of problem orders, determining if the decrease in the number of special measurement orders reflects the optimal system solution.

Stock shirts ordered as special measurement garments:

As noted in the previous section, a persistent quantity of shirts are ordered as special measurement garments even though the identical shirts are part of the stock tariff. The orderer sees no difference in price since DPSC policy is to charge the same amount for special measurement orders as for stock orders.

(This policy will change in FY 98; JROTC units will be charged the actual procurement cost for special measurement orders.)

Depending upon how the stock item is handled by the system, it may be significantly less expensive to the system to have special measurement orders for stock sizes filled from the normal stock tariff process rather than having the shirts manufactured as single units. If the stock shirt comes from a large local inventory, then only the typical item processing cost would be incurred. On the other hand, if the stock shirt were to be ordered as a single unit from a depot, then the depot surcharge per NSN (currently \$29) would offset the increased manufacturing cost of producing a single unit.

This problem should be viewed with caution to see how it develops. As the special measurement process requires less and less time from order placement until garment shipment, it is possible that potential orderers would be willing to place a special measurement order rather than to absorb the cost of alteration in their local funds.

It should be noted that this problem is similar to how to effectively handle orders for single units of garments in general.

Decreasing the amount of time from order origin to shipping:

The amount of time required typically from order origin to shipping of the special measurement garment to the customer should be decreased significantly. Achieving further major decreases will require that orders move continuously through the entire process. Automation of the entire process, with the accompanying decrease in the number of manual interventions, is needed.

Steps in the direction of decreasing manual interventions have been undertaken as part of other ARN projects. These steps include: an electronic order form, automated size assignment, automated marker generation

Electronic order form: This form will reside on a web site. The orderer will interact with the form, providing both procurement and body measurement information. After the form has been completed, the information will be electronically transmitted to the appropriate group within DPSC. DPSC will, in turn, extract the necessary information from the form, couple it with contract information, and re-transmit to a manufacturer. The manufacturer will electronically receive the information into CARGOES (or other software of his choice) and place the order into production.

This process will eliminate all the multiple manual manipulations currently required. Presently, special measurement orders flow outside of the normal

automated order processes, requiring many manual interventions. All these interventions add to the prior-to-production time.

Automated size assignment: Once the orderer's body measurements have been received at the manufacturer, he must translate the measurements into patterns for a garment. CARGOES was designed with a decision support module to assist this assignment process. Rules for ranges of differences between body measurements and garment dimensions were developed for the Army men's and women's and the Air Force women's shirts. These rules are based upon observations of how professional fitters fit these shirts to people.

The output from the assignment module is a sheet for the marker maker which tells the marker maker which extended grade rule, pre-altered pattern, or additional pattern modifications are needed. Currently these assignments are manually verified against each order to determine if the rules are working correctly.

If this process is to be extended to other garments, then both the collection of grade rule extension and pre-altered patterns as well as the rules for assignment must be developed for each new garment style added.

A variant of the process is to develop a file structure which permits a commercial product, Nester, to extract the necessary pattern pieces for a garment and then to automatically generate the marker. Files containing all the possible modifications of individual pieces in each size would have to be created. For instance, there would be a file with a size 22 left front, another file with a size 22 plus bust left front, a file with a size 22 back, a file with a size 22 collar, a file with a size 22 collar band, and so on. Every modification of every piece in every size would have a separate file. The output of the size assignment module would tell Nester which files to use for a specific shirt. Nester would select the pieces and then generate an automatic marker.

The disadvantage to this process is the necessity of creating all the pattern piece files. File storage is no longer a significant problem for apparel CAD systems. This process would have to be used for each new garment style, (i.e., new garment pattern).

Another variant is to use a tailoring 'blue pencil' package such as the Gerber MTM. In MTM the potential user must select a sample size from an existing pattern and then develop the rules which tell points on the perimeter of the pattern pieces how to move in response to a particular body measurement. Considerable up-front time by a skilled professional is required to setup files for tailored garments. After the modified pattern pieces have been generated, smoothing may be required to achieve an acceptable pattern.

The advantage to this process is that new garments, if sufficiently similar to one with an existing MTM file, may be able to use the same rules as the existing garment. So the entire process may not have to start from zero each time a new garment is added to the special measurement process.

A marker would still have to be made, either manually or with an automated system.

A third option is to take the body measurements, send them out to a file, and have a skilled pattern maker manually translate the measurements into a unique garment for each orderer. This procedure requires the least upfront investment but the most investment by a manufacturer or other supplier of patterns to the manufacturer. Given the level of pattern expertise at a typical Government contractor, this option is not practical for the typical contractor.

Form Errors

A persistent, major problem has been the incidence of errors on the special measurement forms (DD 358 or DD 1111) and/or the accompanying paperwork. These errors may be missing measurements, questionable measurements, uncertain shipping instructions, or uncertainties about which shirt has been ordered (SS or LS).

Statistics on errors were generated by taking a random sample of 150 forms each of Army men's and women's shirt orders and then analyzing the errors. The extent of this problem can be seen in Charts 21 and 22

Army Women's Order Form Errors

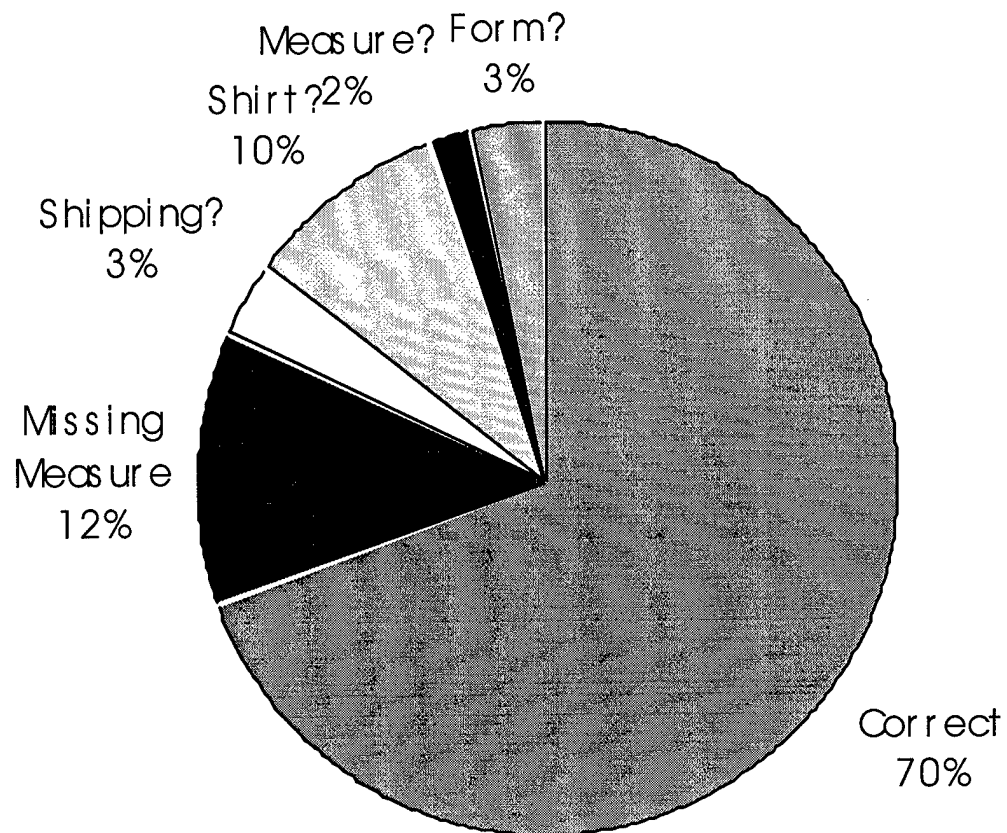


CHART 20: NATURE OF ERRORS ON ARMY WOMEN'S AG415 SHIRT SPECIAL MEASUREMENT FORMS

Army Men's Order Errors

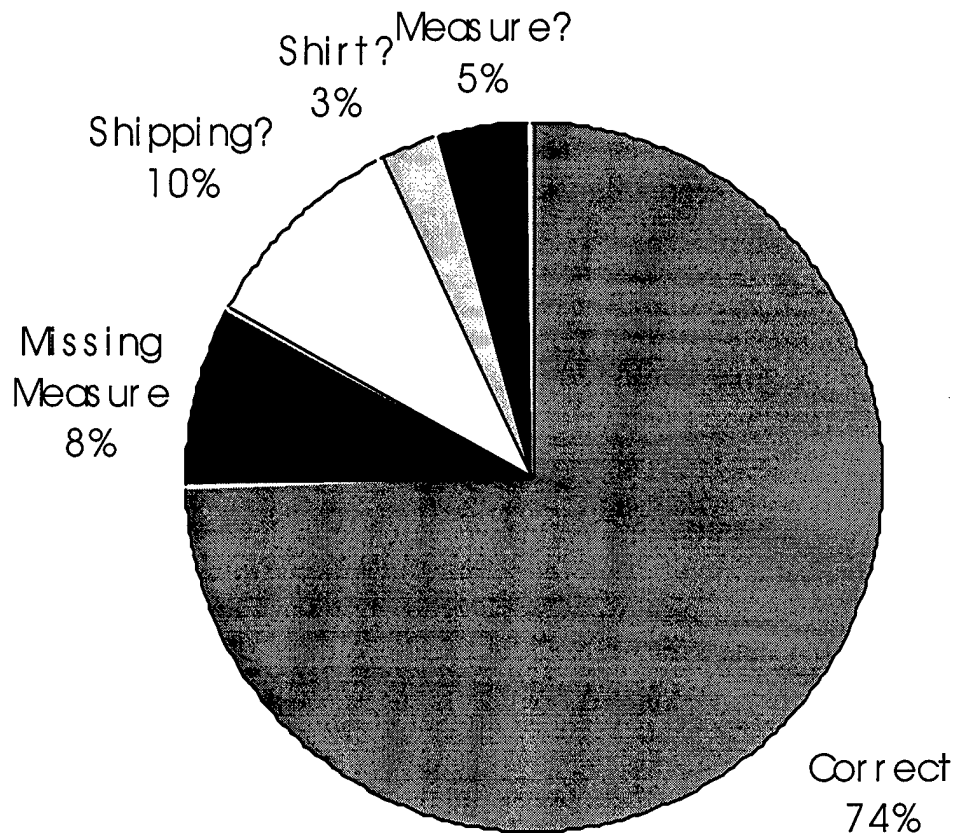


CHART 21: NATURE OF ERRORS ON ARMY MEN'S AG415 SHIRT SPECIAL MEASUREMENT FORMS

(Missing Measurement: a critical measurement is not on the form, such as no collar size for a man's shirt; Shipping?: shipping directions are not clearly given so that there is not certainty that the shipment would be received, Shirt?: supplied form does not clearly state whether the shirt ordered is a long sleeve or short sleeve, Measurement?: there is a question about the accuracy of a provided measurement such as a nine inch collar on a man's shirt)

It is not possible to quantify a typical amount of time required to resolve an error. In general the procedure used involved identifying the error and then either calling the orderer directly if a telephone number were available, or calling the special measurement office at DPSC and asking them to followup

on the error. Even when little CAR personnel time was required, the delay in manufacturing time was appreciable. It was not unusual for an order to be delayed for months, waiting for a resolution to the error. In some cases, CAR went ahead and manufactured the shirt, anticipating that the orderer would return any shirts that were seriously wrong; this procedure might prove to be less time-consuming than waiting for better data. Few shirts were ever returned.

The ARN project on the electronic order form is designed to minimize these kinds of problems. The electronic form requires both complete input of procurement kinds of information (such as shipping address and what exactly is being ordered) and body measurement data. With the current paper forms which include the possibility of ordering any garment with the same form, orderers frequently fail to fill in all the measurements needed for a shirt. For instance, they fail to supply hip circumference so then there is a question about whether the sweep of the shirt will be large enough, particularly for an orderer of a large shirt.

The electronic order form also incorporates on-board error checking in order to minimize the incidence of bad measurement data. The error checking is built upon the 1988 ANSUR data which incorporated data from approximately ten thousand soldiers. These data permit developing ranges for (un)certainly of measurement information. When questionable data are encountered, the orderer is queried for additional information and cautioned about the need for accurate measurements. At the end of this process, the orderer can still input the suspect measurements since there is a possibility that the measurement, although seemingly out of range, is still valid. An example of this situation was the receipt of an order for a special measurement shirt for a recruit with 15.5 neck and 24 inch sleeves. The sleeve length was correct although unusual.

IMPLEMENTATION

Initial development and implementation of these procedures has been in the demo facility at Clemson Apparel Research. Although the procedures have been given extensive use over the past three years, it is recognized that the demo facility is not totally representative of typical government contractors who manufacture special measurement garments.

Accordingly, arrangements have been made with a government contractor to utilize these procedures. Installation of the software was begun in July 1997. During installation, a number of features of CARGOES had to be modified to incorporate the different procedures used by Contracting with the Government contractor as opposed to the CAR Demo. Additional modifications were made to minimize duplicate paperwork conditioned by the contractor's use of its commercial system as well as the Government system.

An enhanced size assignment module, designed for ready incorporation of new garments and new modified patterns, is being included. Full-scale testing is expected at the beginning of December 1997.

In the meantime, the Government contractor has been using the database with manual size assignment.

As detailed information on the working of the system is obtained, it will be reported.

CARGOES

As detailed earlier, CAR found that it was necessary to switch from using linked spreadsheets and text documents to a true database. During the Fall of 1996, formats and screens were constructed using Microsoft's Access and Visual Basic software.

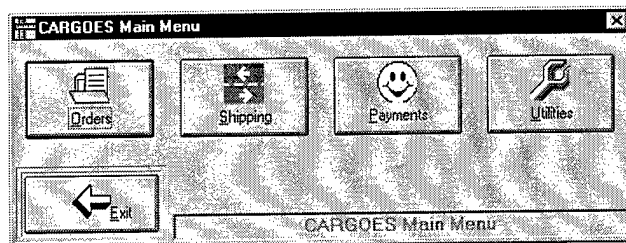
The resulting product is called CARGOES (Clemson Apparel Research Government Order Entry System). CARGOES is designed to assist in handling orders from initial order receipt through production and shipping and invoicing.

The next few pages show the screens that a person using the system would see.

Cargoes Screen Descriptions

Main Menu

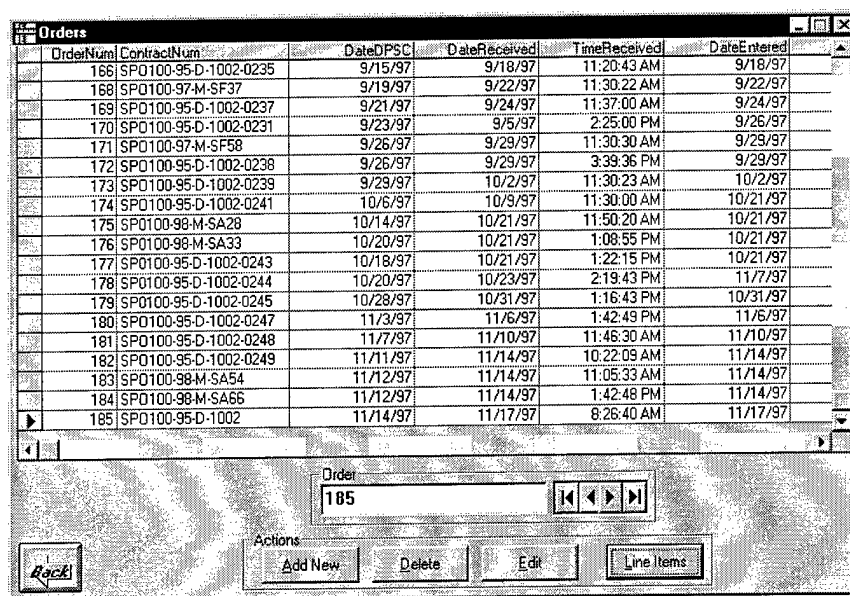
The Main Menu screen is used to select the main function to be performed.



Orders - enter or update orders, order line items, measurement, and sizing information.
Shipping - build shipments and invoices (DD250is) from completed bundles.
Payments - post receipt of payments for invoices.
Utilities - menu of less frequently used functions such as updating DODAACís.

Order Menu

The Order Menu screen is used to select an order and the action to be taken.



Existing orders are displayed in a grid and can be selected to change the current order number. An existing order can be edited or deleted. An Add creates a new order number.

Order Entry

The Order Entry screen allows you to enter or update information concerning the order.

Order Entry

Order Number: 185

Contract-Order: SP0100-95-D-1002 Date Received: 11/17/97

DPSC Date: 11/14/97 Time Received: 8:26:40 AM

Order Type:
☐ Quick Response
☒ Special Measurement

Date Due: 11/26/97

Days Until Delivery: 9

Administered By: SP0100

Default Bill To: OHM27

Default Ship To:

Buttons: DDDAAC, [OK], [Cancel]

After pressing OK, you automatically go to the order line items.

Order Line Items

The Order Line Items screen is used to select a line item and the action to be taken.

Order Line Items

SM Order 183

Contract Number: SP0100-98-M-SA54 Date Due: 12/3/97

CLIN	Requestion Number	Last Name	First Name	OrderQuantity	ShipQuantity
1	HX47C97288460W	HENDERSON	JULIE	3	0
2	HX47C97288400W	HENDERSON	JULIE	3	0
3	HX21597300400W	WEAVER	MEGAN	2	0
4	HX21597301400W	RUSSELL	ALICIA	2	0
5	HX21597302400W	MIDRIFF	HEATHER	2	0
6	HX21597302460W	MIDRIFF	HEATHER	2	0
7	HX21597301460W	RUSSELL	ALICIA	2	0
8	HX21597300460W	WEAVER	MEGAN	2	0

Navigation: [Back], [First], [Previous], [1], [Next], [Last]

Actions: [Add], [Delete], [Edit]

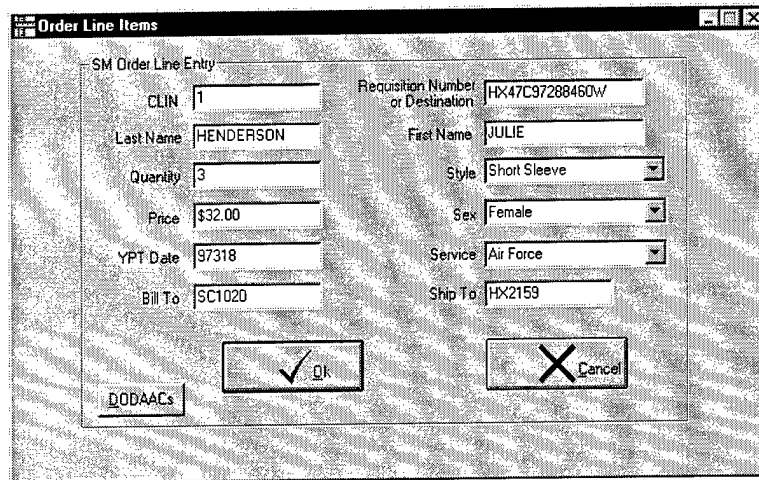
Options: ☐ Mark Line ☐ Process All

Buttons: [Measurements], [Sizing], [Assign C/B], [Marker Form]

Existing line items are displayed in a grid and can be selected to change the line item. An existing line can be edited or deleted. An Add creates a new order line item. Measurements is for going to the appropriate measurements screen, Sizing for calculating sizing information, Assign C/B for assigning cuts and bundles, and Marker Form for printing marker forms.

Line Entry

The line item screen is used to enter or edit order line item information.

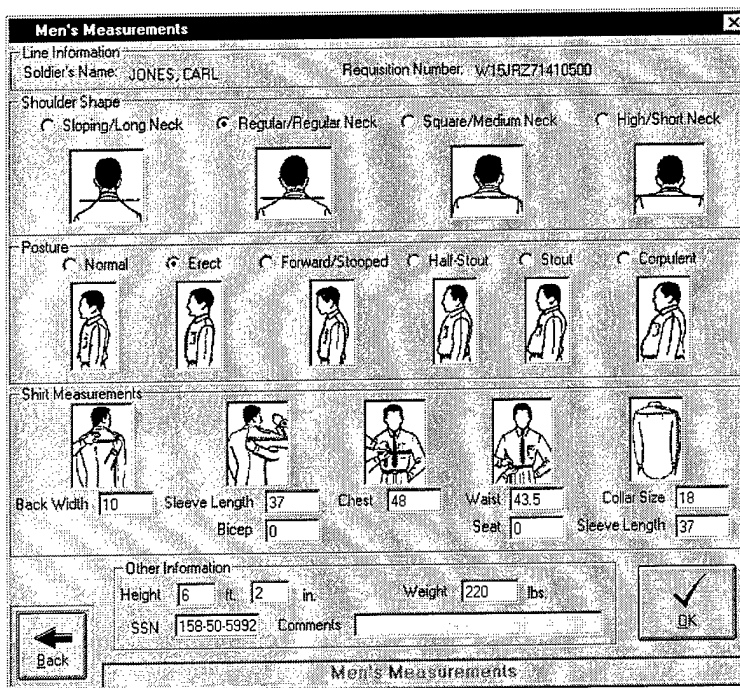


The "Order Line Items" screen is a form for entering or editing order line item information. It contains the following fields and controls:

- SM Order Line Entry**: Title of the screen.
- CLIN**: Text field with value "1".
- Requisition Number or Destination**: Text field with value "HX47C97288460W".
- Last Name**: Text field with value "HENDERSON".
- First Name**: Text field with value "JULIE".
- Quantity**: Text field with value "3".
- Style**: Dropdown menu with value "Short Sleeve".
- Price**: Text field with value "\$32.00".
- Sex**: Dropdown menu with value "Female".
- YPT Date**: Text field with value "97318".
- Service**: Dropdown menu with value "Air Force".
- Bill To**: Text field with value "SC1020".
- Ship To**: Text field with value "HX2159".
- Buttons**: "OK" (checkmark icon), "Cancel" (X icon), and "DODAACS" (underline D).

Measurements

The Woman's Measurements and Men's Measurements screens are for entering or editing line item measurement information.

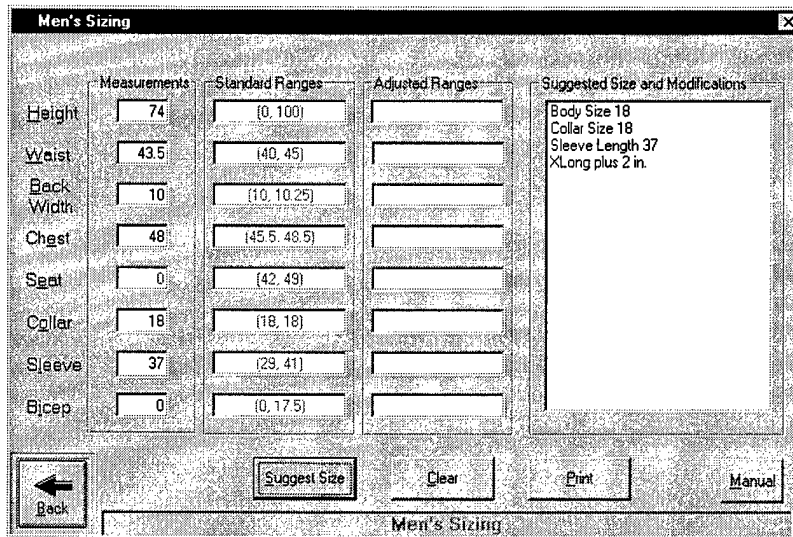


The "Men's Measurements" screen is a form for entering or editing line item measurement information. It contains the following sections and fields:

- Line Information**:
 - Soldier's Name**: Text field with value "JONES, CARL".
 - Requisition Number**: Text field with value "W15JRPZ71410500".
- Shoulder Shape**: Radio buttons for "Sloping/Long Neck", "Regular/Regular Neck" (selected), "Square/Medium Neck", and "High/Short Neck". Below each radio button is a corresponding icon of a man's head and shoulders.
- Posture**: Radio buttons for "Normal", "Erect" (selected), "Forward/Stooped", "Half-Stout", "Stout", and "Corpulent". Below each radio button is a corresponding icon of a man's head and shoulders.
- Shirt Measurements**: Five icons representing different shirt measurement points: Back Width, Sleeve Length, Chest, Waist, and Collar Size. Below each icon are text fields for the measurement values:
 - Back Width**: 10
 - Sleeve Length**: 37
 - Chest**: 48
 - Waist**: 43.5
 - Collar Size**: 18
- Other Information**:
 - Height**: 6 ft, 2 in.
 - Weight**: 220 lbs.
 - SSN**: 158-50-5992
 - Comments**: Text field.
- Buttons**: "Back" (left arrow icon), "OK" (checkmark icon), and "Men's Measurements" (text label).

Sizing

The Woman's Sizing and Men's Sizing screens are used for calculating size information.



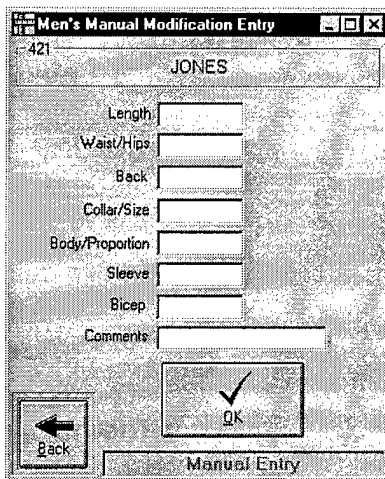
The 'Men's Sizing' screen is a software window with a title bar and a close button. It contains four main columns: 'Measurements', 'Standard Ranges', 'Adjusted Ranges', and 'Suggested Size and Modifications'. The 'Measurements' column lists various body measurements with input fields: Height (74), Waist (43.5), Back Width (10), Chest (48), Seat (0), Collar (18), Sleeve (37), and Bicep (0). The 'Standard Ranges' column provides standard size ranges for each measurement, such as (0, 100) for Height and (40, 45) for Waist. The 'Adjusted Ranges' column has empty input fields for user-defined ranges. The 'Suggested Size and Modifications' column displays the resulting size recommendations: Body Size 18, Collar Size 18, Sleeve Length 37, and XLong plus 2 in. At the bottom, there are buttons for 'Back', 'Suggest Size', 'Clear', 'Print', and 'Manual'.

Measurements	Standard Ranges	Adjusted Ranges	Suggested Size and Modifications
Height	(0, 100)		Body Size 18 Collar Size 18 Sleeve Length 37 XLong plus 2 in.
Waist	(40, 45)		
Back Width	(10, 10.25)		
Chest	(45.5, 48.5)		
Seat	(42, 49)		
Collar	(18, 18)		
Sleeve	(29, 41)		
Bicep	(0, 17.5)		

Buttons: Back, Suggest Size, Clear, Print, Manual

Manual Sizing

The Woman's and Man's Manual Modification Entry screens are used for entering manual sizing information.



The 'Men's Manual Modification Entry' screen is a software window with a title bar and standard window controls. It displays the name 'JONES' and a numerical value '421'. Below this, there are input fields for 'Length', 'Waist/Hips', 'Back', 'Collar/Size', 'Body/Proportion', 'Sleeve', and 'Bicep'. A 'Comments' field is located at the bottom left. A large 'OK' button with a checkmark is positioned in the center-right. At the bottom left, there is a 'Back' button. The title bar of the window reads 'Men's Manual Modification Entry'.

Fields: Length, Waist/Hips, Back, Collar/Size, Body/Proportion, Sleeve, Bicep, Comments

Buttons: Back, OK

Marker Form

The Marker Item Select screen is used to select the line items for printing marker forms.

Ship

The Ship Shirts Process screen is used to select ranges of cuts and bundles for shipping.

CutNum	BdlNum	CARNum	LastName	FirstName	ShipDODAAC	ContractNum	ShirtPrice	Style
26	1	26	KYLES	SHAUNIKA	HX43K6	SP0100-97-M-SA82	32	L
26	2	26	BYRD	SHANNA	HX43M1	SP0100-97-M-SA82	32	L
38	1	32	HARRIS	WENDY	HX2342	SP0100-97-M-SA77	29	S
38	2	32	HARRIS	WENDY	HX2342	SP0100-97-M-SA77	29	S
38	3	30	GRAYSON	DIANE	HX2313	SP0100-97-M-SA77	29	S
38	4	30	GRAYSON	DIANE	HX2313	SP0100-97-M-SA77	29	S
38	5	30	GRAYSON	DIANE	HX2313	SP0100-97-M-SA77	29	S
38	6	30	GRAYSON	DIANE	HX2313	SP0100-97-M-SA77	29	S

CutNum	BdlNum	CARNum	LastName	FirstName	ShipDODAAC	ContractNum
7	1	6	ROBERTS	LAURETTA	FB3048	SP0100-97-M-SA78
7	2	6	ROBERTS	LAURETTA	FB3048	SP0100-97-M-SA78
7	3	6	ROBERTS	LAURETTA	FB3048	SP0100-97-M-SA78

Selected bundles are displayed in a grid until processed and DD250 invoices printed.

Payment

The Payment Processing screen is used to enter or update payment information.

Payment Processing

Input Invoice #: 112-0002

Payment Check Information

Received Date: 6/17/97 Amount: \$0.00 Check #:

OK Cancel

Invoice	FreightCharge	DateShipped	ShippedTo	DeliveryConfirmationNumber
112-0002	0	4/18/97	HX3335	

Invoice	CARNum	Qty	CLIN	RegNum	Cost	Sex
112-0002	249	1	3	HX33357084190H	0	Male
112-0002	248	1	2	HX33357083111H	0	Male

Total: 2

Back Input Pmt Display Pmt Delete Pmt Tracking Date

Payment Processing

Display Payment

The Shipment and Payment Display screen displays a variety of shipment and payment information in four sections.

Shipment and Payment Display

Total charge: 0.00 Received Amount: \$7.00

Invoice	OrderNumber	Quantity	D.
97-0001	97	6	
97-0002Z	97	2	
98-0001	98	1	
98-0002	98	2	
98-0003	98	2	
98-0004	98	2	
98-0005Z	98	2	

Record 169 of 180 in Invoice

PayNo	Invoice	PayReceivedDate
33	97-0002Z	3/10/97

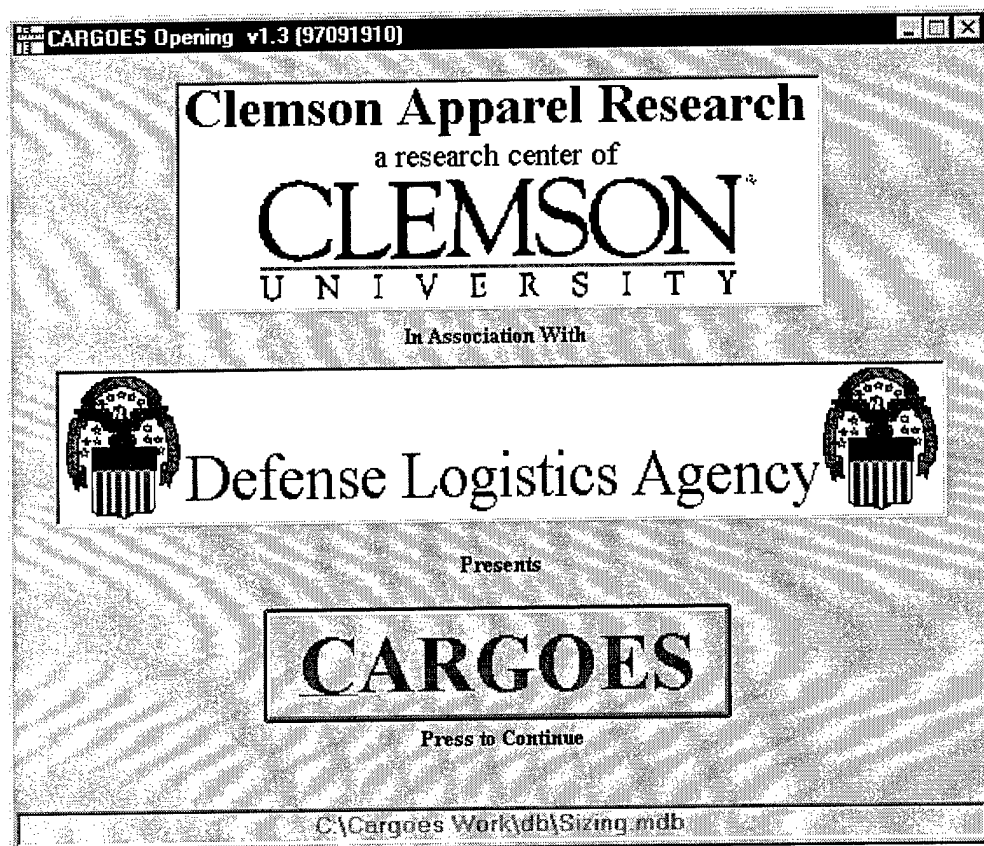
Record 1 of 1 in Pay Display Query

Invoice	BdNum	CARNum	ContractNum

Record 0 of 0 in BundleShipLineOrder

PayNo	CARNum	Amount
33	150	35
33	151	32

Record 1 of 2 in PayPartial Display



Someone at a manufacturer wanting to input a new special measurement order (which had been received from DPSC) would first see the Main Menu screen and would select Orders. When the Order Menu appeared, he/she would then select AddNew, which would bring up the Order Entry screen.

On the Order Entry screen, he/she would input the procurement information for the special measurement order. When OK is selected after the information has been input, then the Order Line screen would appear. Add would be used to permit the input of the detailed information on the particular garment wanted. The order entry person would then return to the Order Line screen.

On this screen, the Measurement options would be selected so that the orderer's body measurements could be input. When OK was selected, the screen would then return to the Order Line screen.

On this third encounter with the Order Line screen, Sizing would be selected. This option links to the decision support system which will suggest a size garment which is selected from the extended grade rule, pre-altered sizes and stock sizes. The ranges used for the suggested size are shown as well as the suggested size. At this point, the size selection may be overridden manually.

Once a size has been determined, the order or group of orders is sent to the Marker Form by way of the Marker Item Select screen. The actual assignment of shirts to markers is performed manually if a more than one shirt marker is required.

When the shirts have been manufactured, then the Shipping option is selected from the Main Menu. On the Ship Shirts Process screen, bundles of shirts are selected and DD250 invoices and accompanying letters are printed.

When payment is received from DFAS, then the Main Menu is re-entered and the Payment option selected. The Payment Processing screen then is used to enter payment information.

A summary screen, the Shipment and Payment Display, may be used to observe the overall status of orders.

A copy of the current version of the Users' Manual is contained in Appendix 6.

CONCLUSIONS

The processes and techniques developed in the CAR Demo during the years 1993-1997 have proved to be effective for handling large numbers of special measurement shirt orders for the Army men, Army women, and Air Force women.

During this time, significant improvements in the procedures for handling orders at the manufacturer have been made. These improvements have resulted in decreases in the time and cost of special measurement shirts.

Successes include:

- Development of a workable procedure for deciding what size garment to produce for a particular order which uses the capabilities of state-of-the-art CAD systems,

- Development of systems for flowing orders through pre-production, production and post-production processes

- Development of software for use by a manufacturer for minimizing paperwork handling

- Cost reductions in the handling of special measurement orders at a Government contractor

Additional issues which still need to be addressed include:

- Developing a process for minimizing errors on order forms

- Developing procedures for automating the remaining steps for handling orders at the manufacturer

- Minimizing the time for the entire process from initial placement of the order until receipt of a satisfactory fitting garment.

APPENDIX 1 MAPS OF OLD STYLE: NEW STYLE ARMY WOMEN'S AG415 SHIRT SIZES

TABLE 1: MAPS OF OLD STYLE:NEW STYLE ARMY WOMEN'S AG415 SHIRT SIZES

ARMY WOMEN'S AG415 SHORT SLEEVE MAPS 3-96

Old NSN	Old Label	New NSN	New Label
8410-01-323-9611	8S	8410-01-414-6979	4R
8410-01-323-9612	8R	8410-01-414-6979	4R
8410-01-323-9613	8L	8410-01-414-6979	4R
8410-01-323-9615	10S	8410-01-414-6980	6R
8410-01-323-9616	10R	8410-01-414-6980	6R
8410-01-323-9617	10L	8410-01-414-6980	6R
8410-01-323-9619	12S	8410-01-414-6981	8R
8410-01-323-9620	12R	8410-01-414-6981	8R
8410-01-323-9621	12L	8410-01-414-6981	8R
8410-01-323-9623	14S	8410-01-414-7023	10R
8410-01-323-9624	14R	8410-01-414-7023	10R
8410-01-323-9625	14L	8410-01-414-7023	10R
8410-01-323-9593	16S	8410-01-414-7105	12R
8410-01-323-9594	16R	8410-01-414-7105	12R
8410-01-323-9595	16L	8410-01-414-7105	12R
8410-01-323-9596	18S	8410-01-414-7113	14R
8410-01-323-9597	18R	8410-01-414-7113	14R
8410-01-323-9598	18L	8410-01-414-7113	14R
8410-01-323-9599	20S	8410-01-414-7116	16R
8410-01-323-9600	20R	8410-01-414-7116	16R
8410-01-323-9601	20L	8410-01-414-7116	16R
8410-01-323-6100	22R	8410-01-414-7118	18R
8410-01-323-6101	24R	8410-01-414-7120	20R
8410-01-323-6102	26R	8410-01-414-7186	22R
		8410-01-414-7232	24R
		8410-01-414-7233	26R

ARMY WOMEN'S AG415 LONG SLEEVE MAPS 3-96

8410-01-315-7974	8S3S	8410-01-415-1571	4P x 29 1/2	
8410-01-315-7976	8S4S	8410-01-415-1577	4R x 31	
8410-01-315-7975	8R4S	8410-01-415-1577	4R x 31	
8410-01-315-7977	8R5S	8410-01-415-7023	4L x 32 1/2	
8410-01-315-7978	8L5	8410-01-415-7023	4L x 32 1/2	
8410-01-315-7979	8L5S	8410-01-415-7023	4L x 32 1/2	
8410-01-315-7980	10S3S	8410-01-415-1589	6R x 31	
8410-01-315-7981	10S4S	8410-01-415-1589	6R x 31	1/2" shorter
8410-01-315-7982	10R4S	8410-01-415-1589	6R x 31	1/2" shorter
8410-01-315-7983	10R5S	8410-01-415-1594	6L x 32 1/2	
8410-01-315-7984	10L5	8410-01-415-1594	6L x 32 1/2	
8410-01-315-7985	10L5S	8410-01-415-1594	6L x 32 1/2	1/2" shorter
8410-01-315-7986	12S3S	8410-01-415-8425	8R x 31	
8410-01-315-7987	12S4S	8410-01-415-8425	8R x 31	1/2" shorter
8410-01-315-7988	12R4	8410-01-415-1586	8L x 32 1/2	
8410-01-315-7989	12R4S	8410-01-415-1586	8L x 32 1/2	
8410-01-315-7990	12R5	8410-01-415-1586	8L x 32 1/2	
8410-01-315-7991	12R5S	8410-01-415-1586	8L x 32 1/2	
8410-01-315-7992	12L5	8410-01-415-1586	8L x 32 1/2	1/2" shorter
8410-01-315-7993	12L5S	8410-01-415-1586	8L x 32 1/2	1/2" shorter
8410-01-315-7994	12L6	8410-01-415-1586	8L x 32 1/2	1 1/2" shorter
8410-01-315-7995	12L6S	8410-01-415-1586	8L x 32 1/2	1 1/2" shorter
8410-01-315-7996	14S3S	8410-01-415-1576	10R x 31	
8410-01-315-7997	14S4S	8410-01-415-1573	10L x 32 1/2	
8410-01-315-7998	14R4S	8410-01-415-1573	10L x 32 1/2	
8410-01-315-7999	14R5	8410-01-415-1573	10L x 32 1/2	3/4" shorter
8410-01-315-8000	14R5S	8410-01-415-1573	10L x 32 1/2	3/4" shorter
8410-01-315-8001	14L6	8410-01-415-1573	10L x 32 1/2	1" shorter
8410-01-315-8002	14L6S	8410-01-415-1573	10L x 32 1/2	1" shorter
8410-01-315-8003	16S3S	8410-01-415-7027	12R x 31	1/2" shorter
8410-01-315-8004	16S4S	8410-01-415-1580	12L x 32 1/2	
8410-01-315-8005	16R4S	8410-01-415-1580	12L x 32 1/2	
8410-01-315-8006	16R5S	8410-01-415-1580	12L x 32 1/2	1" shorter
8410-01-315-8007	16L6	8410-01-415-1580	12L x 32 1/2	1 1/2" shorter
8410-01-315-8008	16L6S	8410-01-415-1580	12L x 32 1/2	1 1/2" shorter
8410-01-315-8009	18S3S	8410-01-415-1579	14L x 32 1/2	3/4" longer
8410-01-315-8009	18S3S	8410-01-415-1592	14R x 31	3/4" shorter
8410-01-315-8010	18R4S	8410-01-415-1579	14L x 32 1/2	1/2" shorter
8410-01-315-8011	18R5S	8410-01-415-1579	14L x 32 1/2	1 1/2" shorter
8410-01-315-8012	18L6	8410-01-415-1579	14L x 32 1/2	1 1/2" shorter
8410-01-315-7966	18L6S	8410-01-415-1579	14L x 32 1/2	1 1/2" shorter

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8410-01-315-7967	20S4S	8410-01-415-2914	16L x 32 1/2
8410-01-315-7968	20R5S	8410-01-415-2914	16L x 32 1/2 1" shorter
8410-01-315-7969	20L6S	8410-01-415-2914	16L x 32 1/2 2" shorter

APPENDIX 2: CHARTS OF ARMY MEN'S SHIRTS

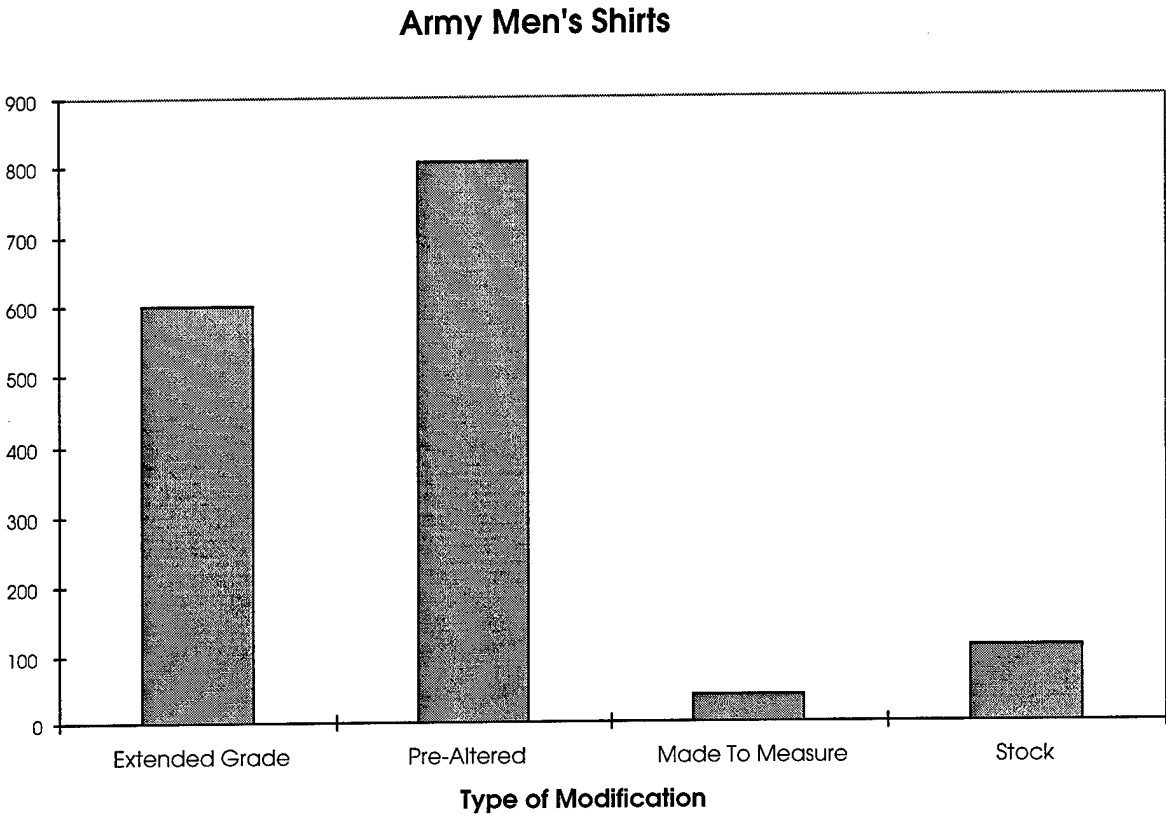


CHART 2: BREAKDOWN OF MODIFICATIONS FOR ARMY MEN'S SHIRTS

Army Men's Pre-Altered Shirts

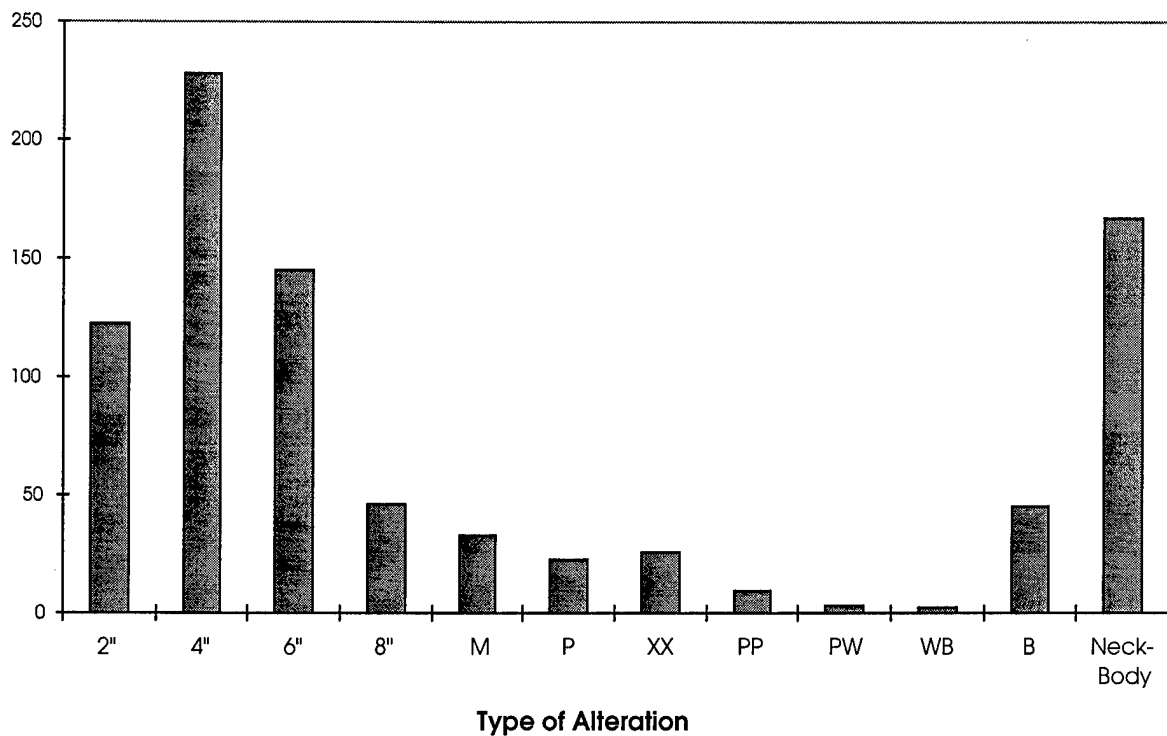


CHART 3: ANALYSIS OF TYPE OF ALTERATION FOR PRE-ALTERED ARMY MEN'S SHIRTS

(2, 4, 6, 8: Inches added to body length; M: Minus 7 inches in waist; XX and PP: Added inches in waist and hips; PW: 3.5 inches added to waist; WB: Wide back, 1 inch added to cross shoulder; B: Bicep, 1 inch added to sleeve in bicep area; Neck-Body: Combination of different size collar on shirt body)

Army Men's Shirts

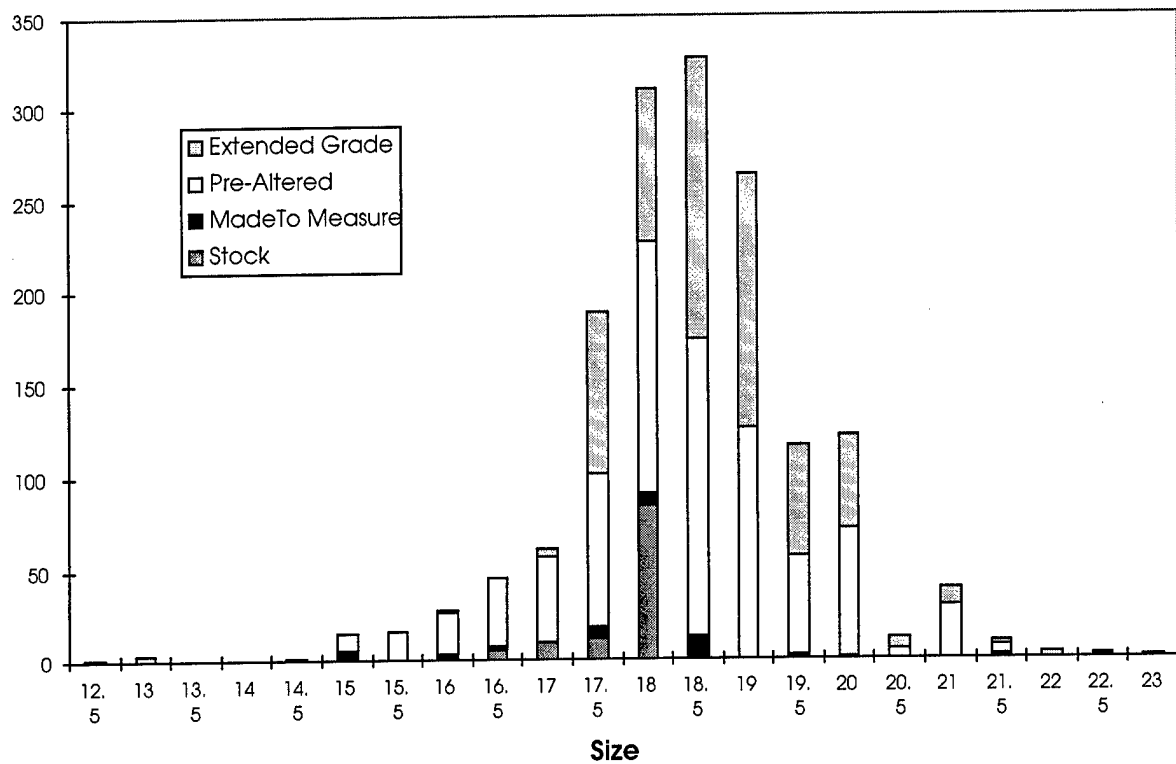


CHART 4: DISTRIBUTION OF MODIFICATIONS REQUIRED FOR ARMY MEN'S SHIRTS BY NOMINAL COLLAR SIZE

APPENDIX 3: CHARTS OF ARMY WOMEN'S SHIRTS

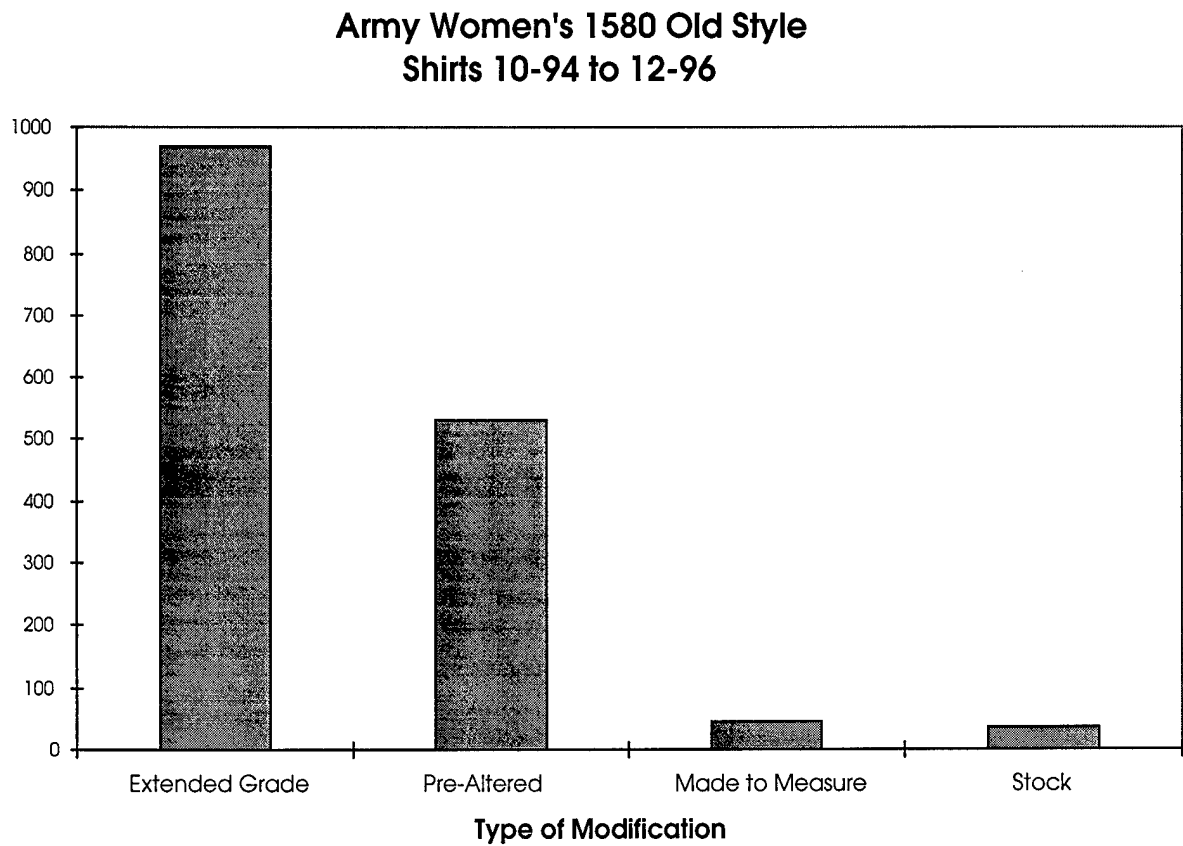


CHART 5: BREAKDOWN OF MODIFICATIONS FOR OLD STYLE ARMY WOMEN'S SHIRTS

Army Women's 531 Old Style Pre-Altered Shirts

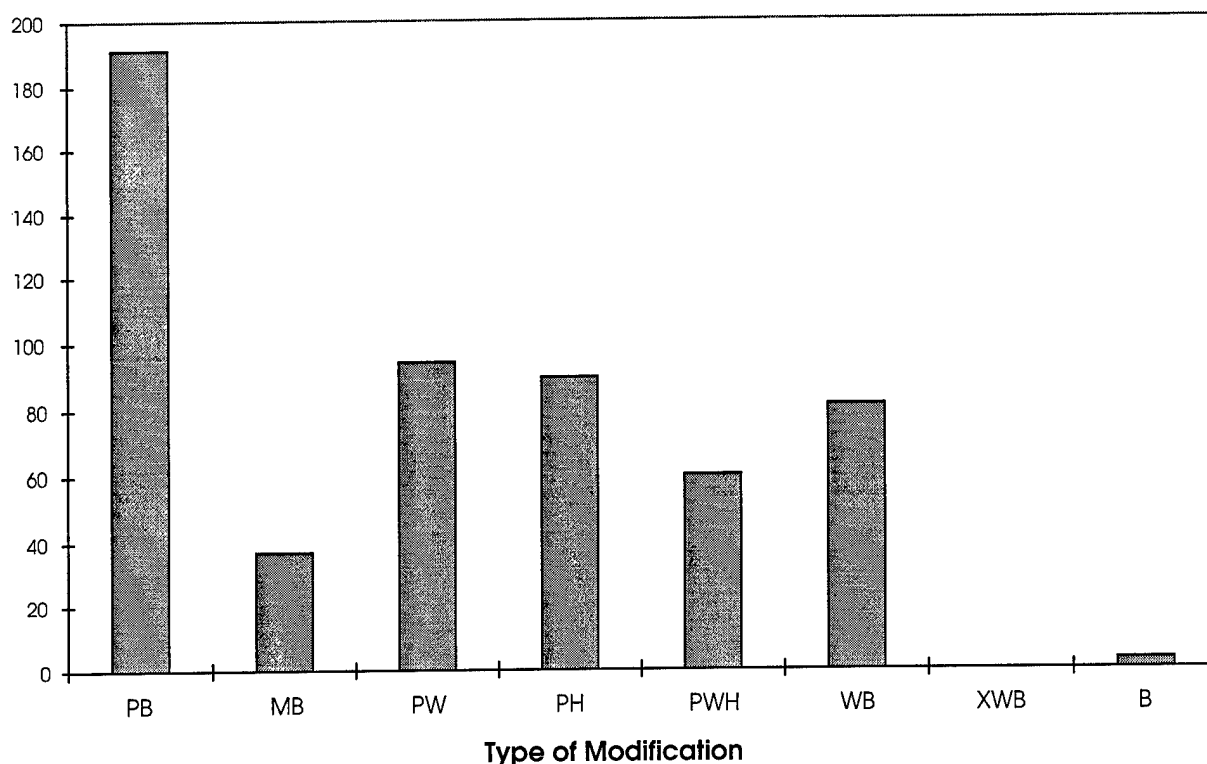


CHART 6: ANALYSIS OF TYPE OF ALTERATION FOR PRE-ALTERED ARMY WOMEN'S OLD STYLE SHIRTS

(PB: Plus bust, 2 inches added in front bust area; MB: Minus bust, one inch removed in front bust area; PW: Plus waist, inches added in the waist; PH: inches added in the hip; PWH: Plus waist and hips; WB: Wide back, one inch added to the back in the cross shoulder; XWB: Extra wide back, two inches added to the cross shoulder; B: Bicep, one inch added to sleeves in the bicep area.)

Army Women's 1580 Old Style Shirts 10-94 to 12-96

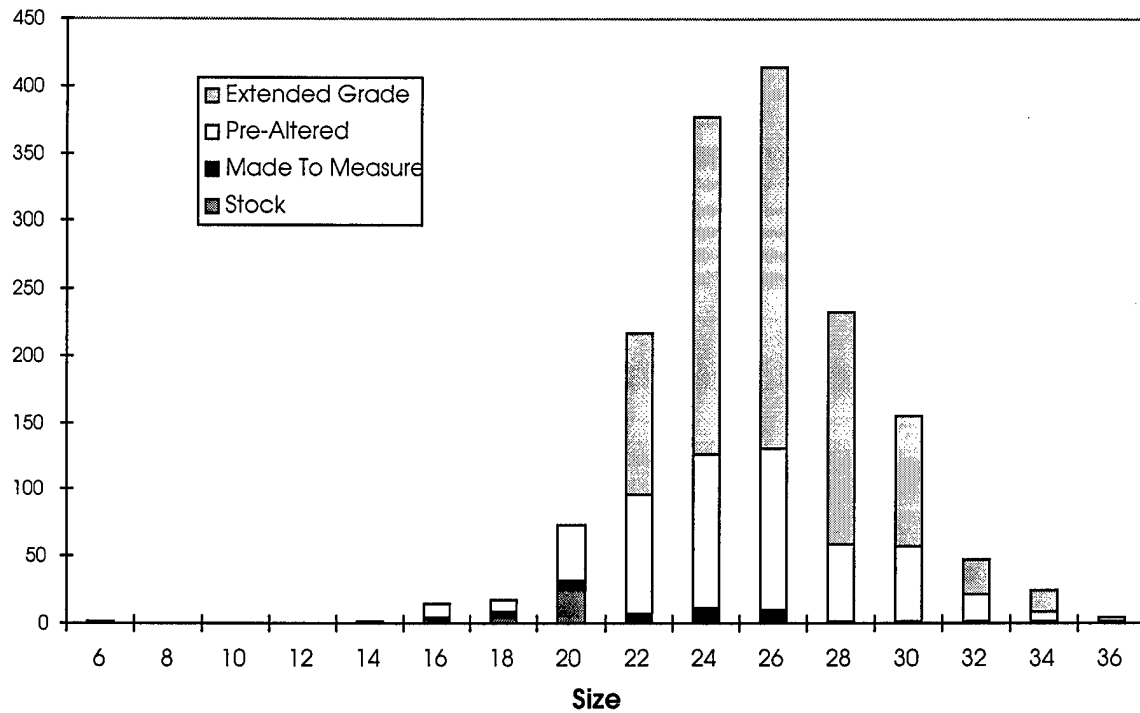


CHART 7: DISTRIBUTION OF MODIFICATIONS REQUIRED FOR ARMY WOMEN'S
OLD STYLE SHIRTS BY NOMINAL BODY SIZE

Army Women's 458 New Style Shirts

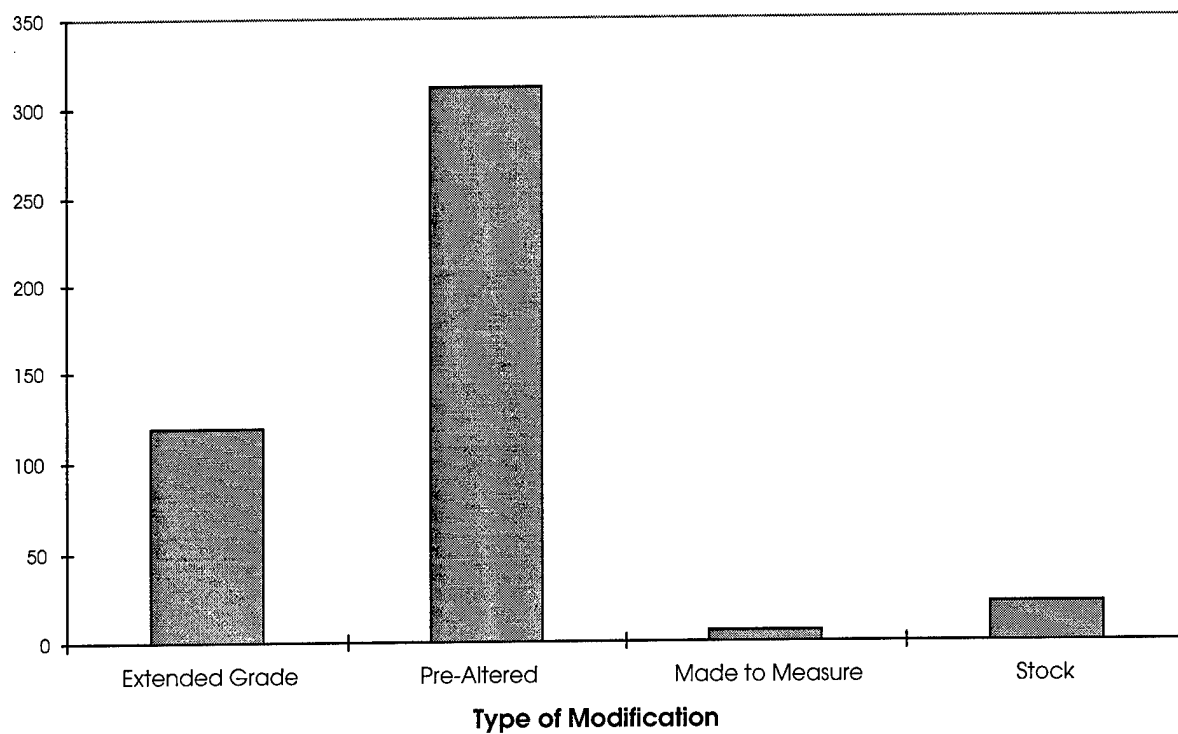


CHART 8: BREAKDOWN OF MODIFICATIONS FOR NEW STYLE ARMY WOMEN'S SHIRTS

Army Women's New Style Pre-Altered Shirts

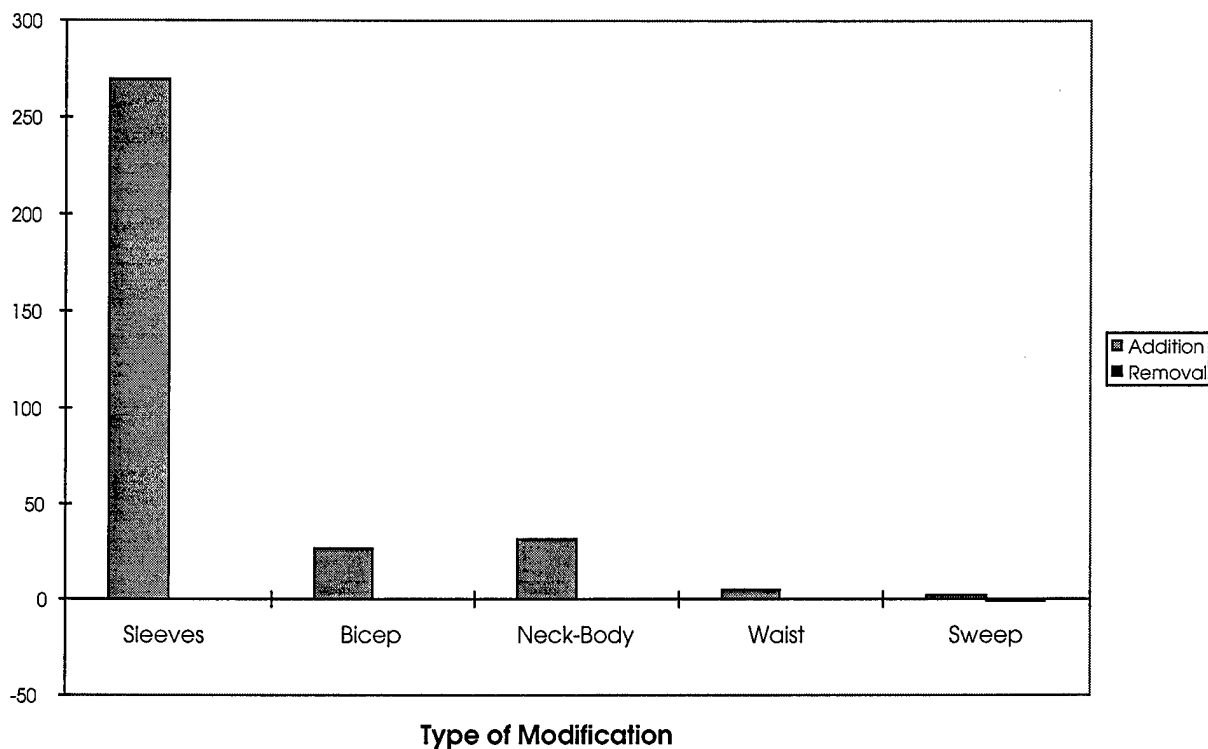


CHART 9: ANALYSIS OF TYPE OF ALTERATION FOR PRE-ALTERED ARMY WOMEN'S NEW STYLE SHIRTS

(Sleeves: 1.5 or 3.0 inches added to longest sleeve length; Bicep: one, two, three or four inches added to sleeve in bicep area; Neck-body: equivalent to men's shirt with larger neck on smaller shirt body; Waist: three inches added in waist area; Sweep: four inches added or three inches removed in hip area)

Army Women's New Style Shirts

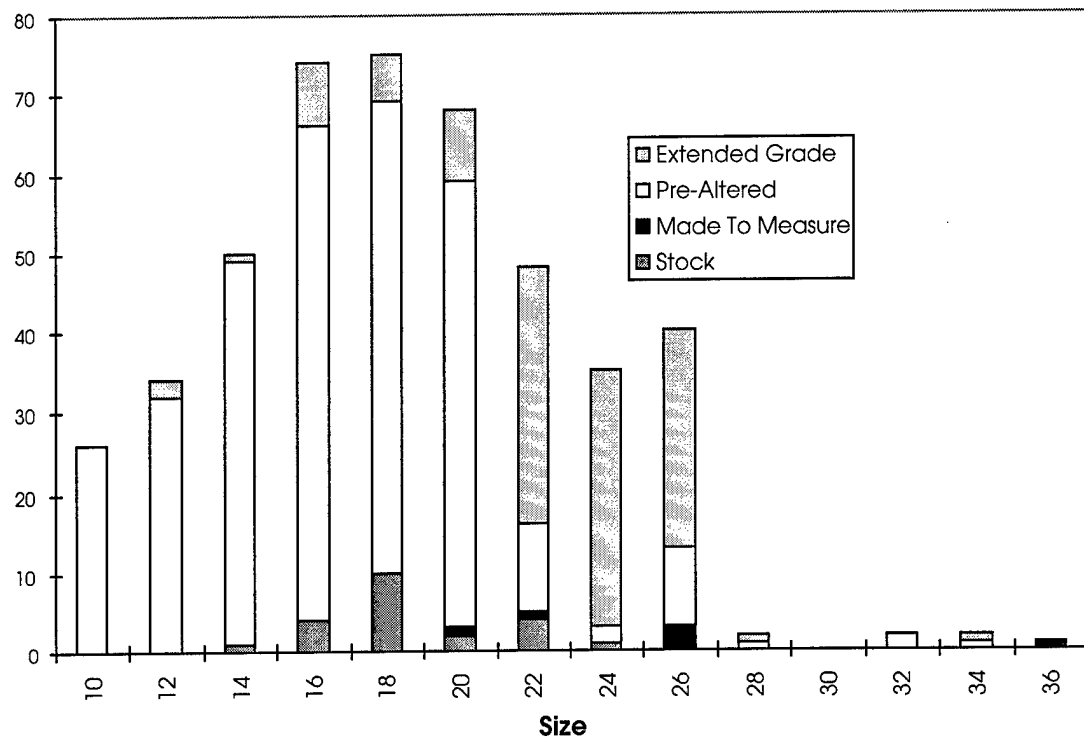


CHART 10: DISTRIBUTION OF MODIFICATIONS REQUIRED FOR ARMY WOMEN'S NEW STYLE SHIRTS BY NOMINAL BODY SIZE

APPENDIX 4. CHARTS OF AIR FORCE WOMEN'S SHIRTS

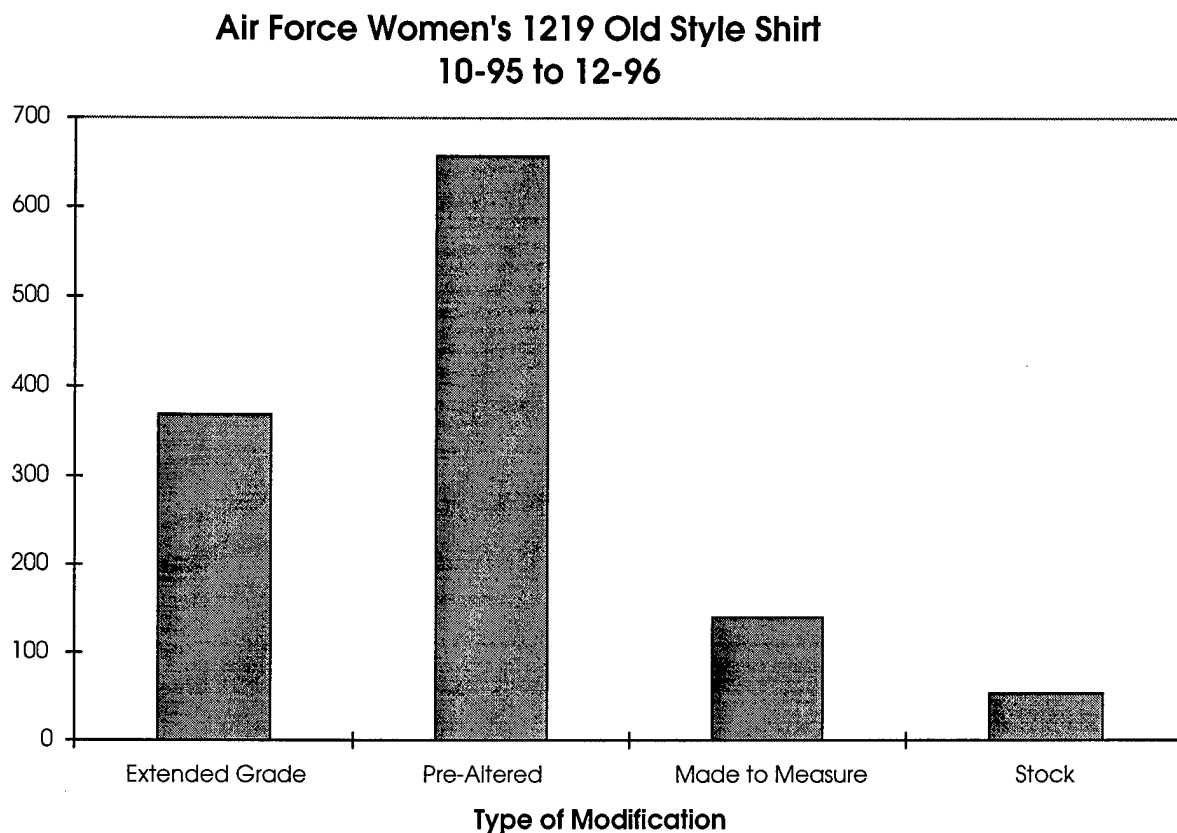


CHART 11: BREAKDOWN OF MODIFICATIONS FOR OLD STYLE AIR FORCE WOMEN'S SHIRTS

Air Force Women's 657 Old Style Pre-Altered Shirts

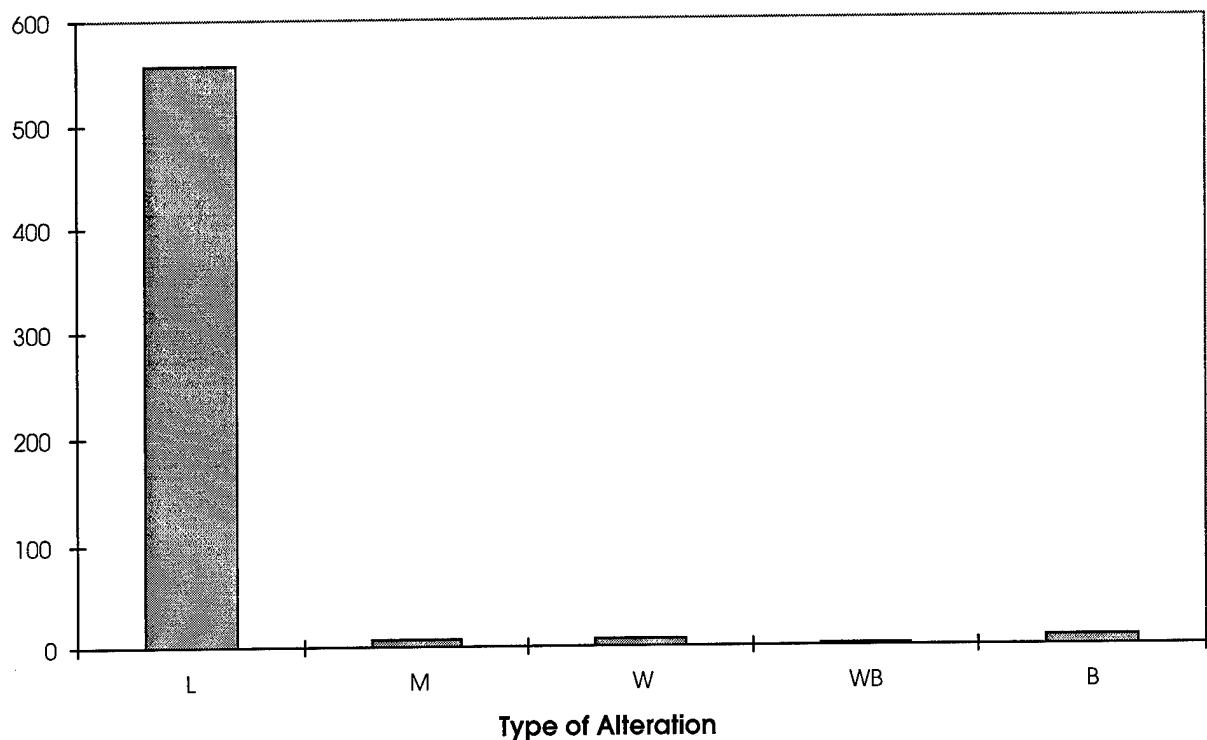


CHART 12: ANALYSIS OF TYPE OF ALTERATION FOR PRE-ALTERED AIR FORCE WOMEN'S OLD STYLE SHIRTS

(L: Two inches added to long sleeve length; M or W: Removal or addition of fabric in waist area; WB: Wide back, one inch added to cross shoulder; B: Bicep, one inch added to sleeve in bicep area)

Air Force Women's 1219 Old Style Shirts 10-95 to 12-96

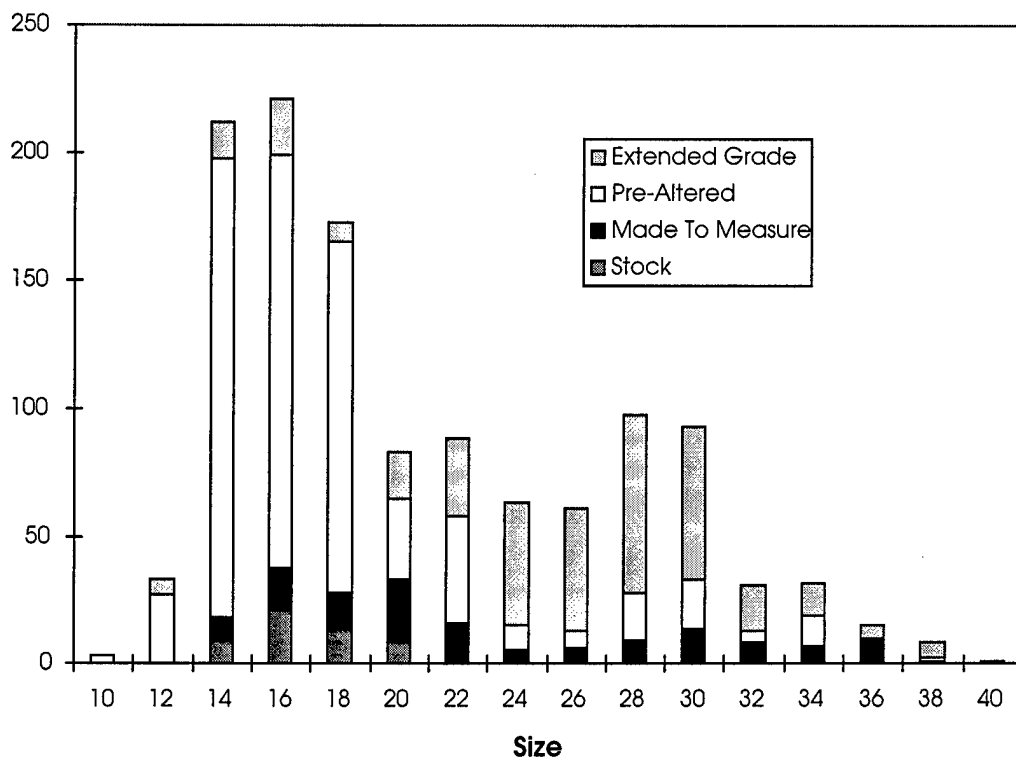


CHART 13: DISTRIBUTION OF MODIFICATIONS REQUIRED FOR AIR FORCE WOMEN'S OLD STYLE SHIRTS BY NOMINAL BODY SIZE

Air Force Women's New Style Shirts

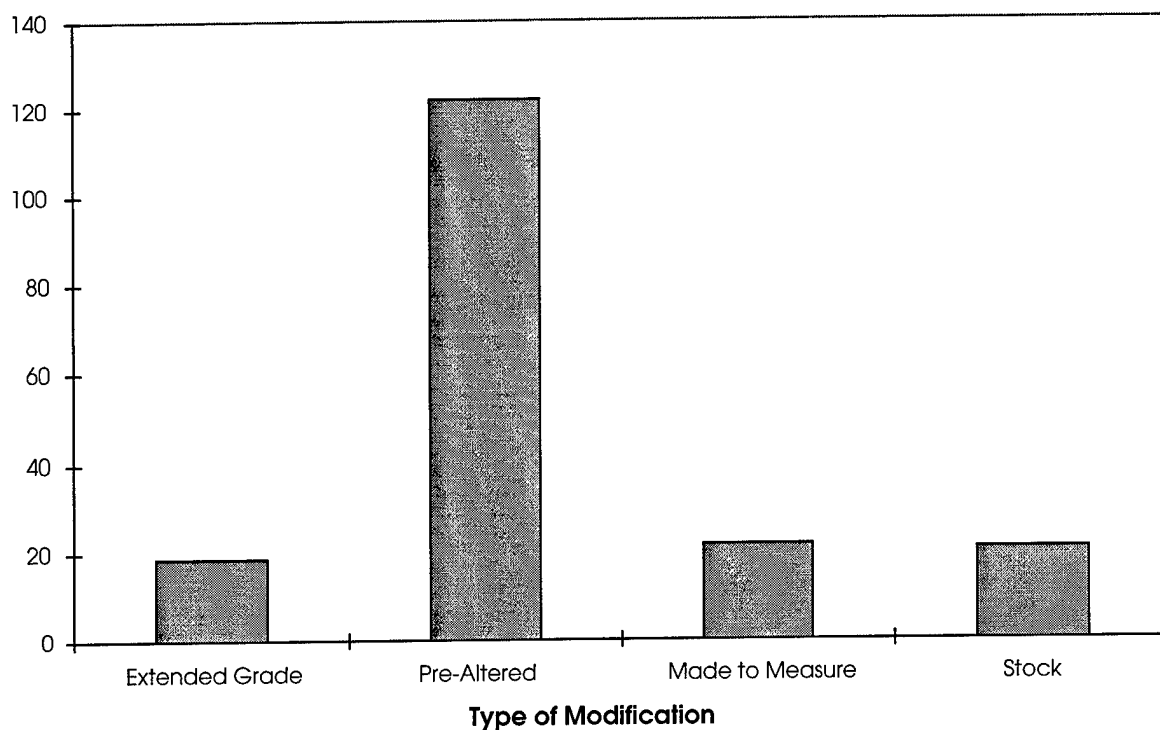


CHART 14: BREAKDOWN OF MODIFICATIONS FOR NEW STYLE AIR FORCE WOMEN'S SHIRTS

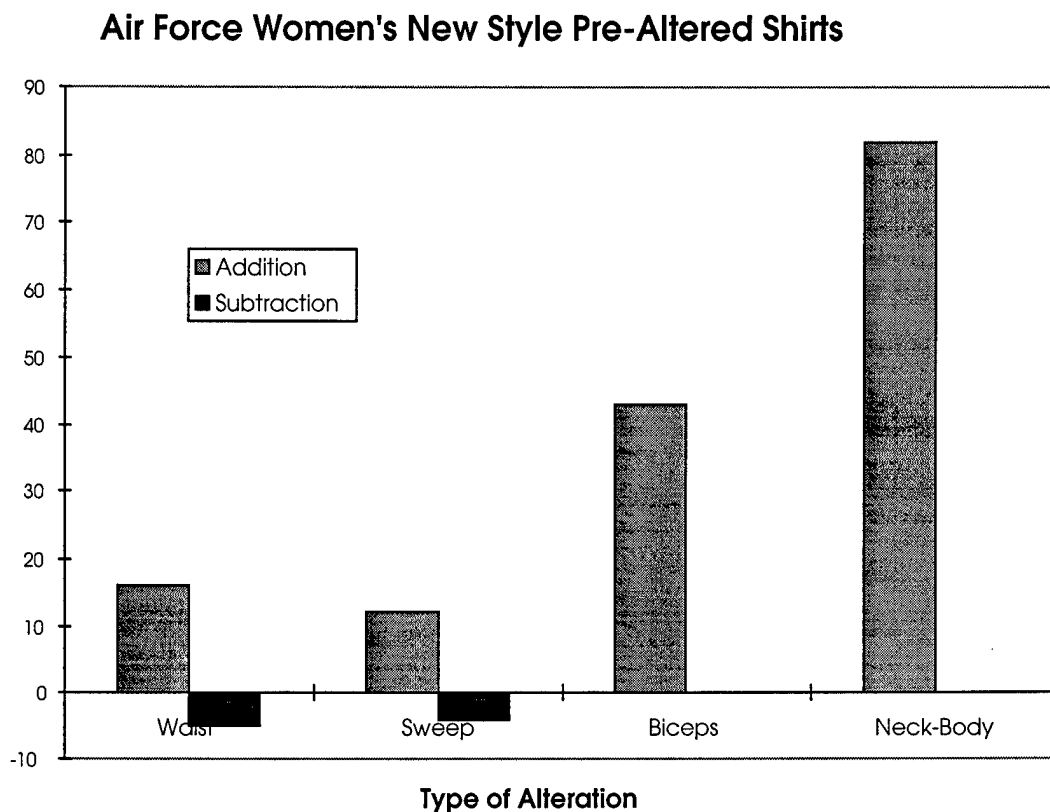


CHART 15: ANALYSIS OF TYPE OF ALTERATION FOR PRE-ALTERED AIR FORCE WOMEN'S NEW STYLE SHIRTS

(Waist: Add or subtract three inches in the waist area; Sweep: Add or subtract four inches in the sweep area; Biceps: Add one, two, three or four inches in the sleeve bicep area; Neck-body: Equivalent to the men's shirt, place a larger neck onto a smaller shirt body)

Air Force Women's New Style Shirts

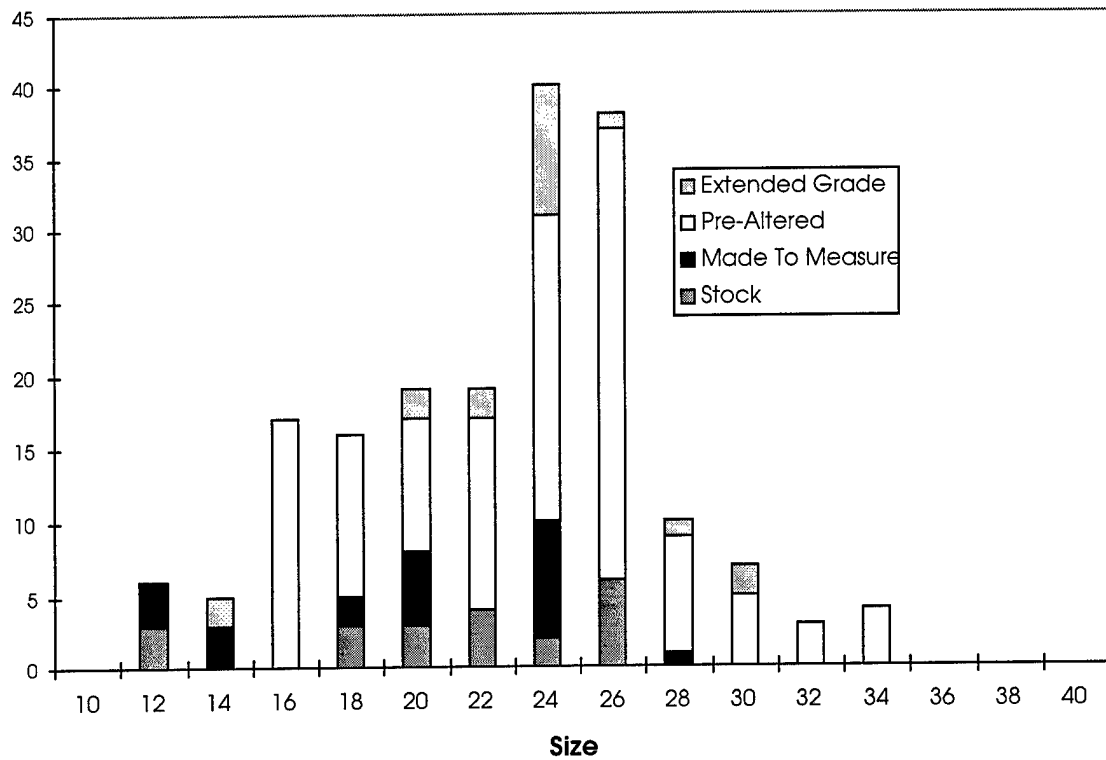


CHART 16: DISTRIBUTION OF MODIFICATIONS REQUIRED FOR AIR FORCE WOMEN'S NEW STYLE SHIRTS BY NOMINAL BODY SIZE

APPENDIX 5: PROCEDURES FOR DEVELOPING PATTERNS USED FOR SPECIAL
MEASUREMENT ORDERS

Clemson Apparel Research

Guidelines for

Using GGT Micromark Software

To Prepare Pre-Altered Patterns for

U.S. Army Women's and Men's

Special Measurement

AG415 Dress Shirts

NANCY J. STAPLES

October 1997

Using the MicroMark CAD System to Create Patterns for Special Measurement Uniforms

Not all special measurement orders are “special”—requiring a unique, non-standard pattern for a unique, non-standard-shaped (or non-standard-sized) person. In fulfilling “special measurement” orders, Clemson Apparel Research discovered that orders called “special measurement” fell into four categories: stock size, extended grade rule, pre-altered (made-to-order), and true special measurement (unique pattern). In order to understand the approach used by CAR to fill “special measurement” shirt orders, it is first necessary to understand some basic principles of working in the MicroMark CAD environment.

Background—MicroMark Basics

The MicroMark CAD system manages files as styles. A Style File contains in a single file all the pattern pieces for a garment, including patterns for all material groups (such as shell, interlining, lining). The pattern pieces themselves have no life except as a part of a Style (unlike CAD systems with a piece-oriented structure). The following procedures are specific to the Style File organizational structure.

The starting point is the Style File for an item. The pattern geometries stored in the Style File are for all the patterns in the sample size in the standard proportions. Through the use of a grade rule table a full range of sizes can be created. The grade rule table indicates the names of the sizes available and the rules for moving points on the perimeter of each pattern piece. Each rule indicates a movement on the x-axis and a movement on the y-axis. When the points which have been moved to new locations, as dictated by the rules (x- and y- increments) for a given size, are connected by the computer, a new size is created. The grade rule table controls only those changes (in length and width) which are required to retain the standard proportions of the sample in a full range of sizes. When there is a need for additional proportions, then an additional table of rules is required.

In MicroMark the synonym table controls the creation of additional proportions from the full range of standard-proportioned sizes. This is a two-step process. The computer first creates the size needed in the standard proportion, then applies the movement indicated in the synonym table to those grade points to which variations have been attached. For example, in men’s long sleeved shirts the sample size may be 16 neck/33 sleeve. For a requested size of 18 neck/35 sleeve, the computer will first grade the pattern to a size 18 neck/33 sleeve. It will then apply the variation for sleeve length to the grade rule points at the wrist of the sleeve, moving them 2 inches on the x-axis to adjust the length of the sleeve to be 2 inches longer. The synonym table for this example basically states the following: if the size desired is 1835, use a size 1833 and make 1 variation of 2 units in Length (where the unit defined in the grade rule is 1 inch). The format for this expression is:

1835 1833 1
2 L

In a Style environment ALL pattern pieces in a given Style will be graded to the same requested standard-proportioned size. ALL pattern pieces in a given Style which have variations attached will be graded to the same requested proportion.

Minor Modifications—Extended Grade Rule

When a need arises for an additional standard-proportioned size for an item, a simple modification to the grade rule table allows the computer to create the new size. A new size name is added to the existing size table. If the x- and y-increments between the new size and its nearest neighbor in the existing rule table are the same as between the nearest neighbor and its adjacent existing size, then answering “yes” to “continue size break” instantly applies those increments for the new size to all the rules in the grade rule table. If new increments are to be used, then it is necessary to edit manually the x- and y-increments for the new size in each rule.

When a need arises for an additional proportion to be available, the existing synonym table must be edited by adding the following expression for each new proportion:

[New proportioned size name] [Existing graded size name] [Number of variations]
[Number of units] [Variation name]

In the method CAR has employed for coping with special measurement orders, the term “Extended Grade Rule” has been used to describe the addition of sizes and variations to the MicroMark grade rule and synonym tables. This provides a simple solution for orders in which the standards already established needed only to be extended to a larger available size range (beyond the stocked size range). The stock sizes for the AG415 men’s shirt at the time the CAR demo took on the manufacture of special measurement orders was as follows:

Neck	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5
Sleeve	29-35	29-37	29-38	29-38	29-38	29-38	29-38	30-38	32-37	32-37

Through “Extended Grade Rule” CAR made available neck sizes 12.5 to 23 with sleeve lengths 29 to 41. Once the additions had been made to the grade rule and synonym tables, all of the following sizes were “available” to be requested in markermaking.

Neck	12.5	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5
Sleeve	26,33	28-38	29-38	29-38	29-38	29-40	29-40	29-40	29-41	29-40	29-41

18	18.5	19	19.5	20	20.5	21	21.5	22	22.5	23
29-41	29-40	29-41	29-40	29-39	29-40	29-40	32-39	32-39	33,35	33,36

Pre-Altered Patterns—Made-to-Order

When altered patterns are traced onto paper and hard copies are sent to a manufacturer, the next time the same modification is encountered it must be traced onto paper again. When patterns are altered in the computer, the modified pattern can be stored in a

separate Style File. The grade rule and synonym tables referenced by this Style File make the modified garment pattern available in the full range of extended sizes. A plot of this pre-altered pattern can be sent as a hard copy to a non-CAD manufacturer or an electronic copy of the file can be sent to a CAD manufacturer. The next time the same alteration is needed, the stored file is accessed for plotting, copying, or markermaking (depending on the user). This is the foundation of the principle of pre-altered patterns for made-to-order modifications to the standard-proportioned item. For modifications which are needed repeatedly this approach is accurate and efficient.

In the process of filling special measurement orders, CAR used the pattern- making tools in the MicroMark CAD system to alter the basic AG415 shirt pattern to accommodate non-standard proportions. As the need for a modification arose, a copy of the AG415 Style File was made, given a new (but related) name, the pattern alteration was made, and the new Style File was stored. In this way a library of pre-altered pattern files was created. It became policy first to determine whether a new order could be filled by one of these stored modifications before a decision was made to create a new, potentially re-usable and potentially unique, pattern modification.

The procedure for creating pre-altered patterns on a CAD system mimics manual pattern alteration. Patternmaking CAD tools such as move, copy, and offset are used to simulate shifting, slashing and spreading, and other techniques for pattern alteration. Since there is more than one way to arrive at any particular alteration, given the multitude of tools available, it is impossible to define step-by-step any one best way to perform a specific alteration. An example of a simple alteration, however, is the addition of circumference at the waist:

- A copy of the 415S (Army men's short-sleeved shirt) Style File is made and is named 415S_P (for plus waist).
- To add 4 inches to the waist, since there are two side seams, each with a front and a back, 1 inch needs to be added to the waist of each side seam.
- In the file 415S_P the offset uneven tool is selected.
- The side seam is selected.
- The space outside of the pattern is indicated as the side where the line is to be offset.
- An offset amount of 1 inch is indicated for a digitized point at the waist level.
- An offset amount of 0 is indicated for the digitized points at the hem/side intersection and the armcye/side intersection.
- Intelligent guesswork is used to indicate an offset amount between 0 and 1 for at least two other points between those previously selected (aiming for a smooth curve as a result).
- The swap tool is used to swap the original side seam line for the offset line.
- The delete tool is used to delete the original side seam line.
- The procedure is repeated for all side seam lines.
- The changes are stored.

This new, larger waist Style is now available in the full range of sizes and proportional variations to be called upon by name as the need arises in another customer's order.

An additional alteration that was found to be needed was a neck/body combination where the neck needed to be either smaller or larger than the body size. To satisfy this need, two types of Style Files were created. One Style File contains all the pattern pieces EXCEPT the collar pieces with pre-altered necklines on the fronts and back. The other Style File contains ONLY the collar pattern pieces. Each "body parts" style has had the neckline changed to reflect the number of sizes larger or smaller than the sample size. For example, 415S_N2 has a neckline 2 sizes larger (equals 1") than the sample size. This modification was made by the following procedure:

- A copy of the 415S (Army men's short-sleeved shirt) Style File is made and is named 415S_N2.
- In the grade menu the grade increments for the neck/shoulder intersection and the center front/neck of the shirt front are reported to determine the actual change in x and y between adjacent sizes.
- In the line menu the neck and shoulder lines are combined.
- Move range menu is used to move the neck at shoulder point the equivalent of two grade increments in x and y, with the start point at the center front and the end point at the shoulder/armcye intersection.
- The procedure is repeated for the back.
- The changes are stored.

When a marker is requested, the Style with the appropriate neck change is requested in the body size and the Style with the collar only is requested in the neck size. The styles in the library of pre-altered patterns at CAR may be found listed, with illustrations of the pattern alterations and garment dimension charts, beginning on page 8.

Note 1: An advantage of using PDS tools for making pattern modifications is the computer's ability to make smooth lines without manipulation of individual points. Blending a changed line into an original line is a part of the PDS tool itself. This is easier to accomplish and requires a lower level of expertise than directing the use of Made-to-Measure software to create acceptable modifications. This is because, in MTM, points must be individually controlled in such a way as to result in lines that are smooth.

Note 2: There is a temptation to use the MicroMark synonym capability (up to ten synonyms are allowed) to create modifications such as the wide back, for example. This could be done BUT it would necessitate a separate "size" name for each size of that modification, such as 15H34WB and 2036WB. MicroMark can only accept 255 individual size names. The sleeve lengths alone already use most of that capacity. For this reason synonyms have been used for the most essential variant, the sleeve length. Pre-altered Style Files have been used for a variety of frequently-needed modifications to make them available in the full range of sizes and sleeve lengths.

True Special Measurement

Orders which could not be satisfied by a stock size pattern, an extended grade rule pattern, or a pre-altered pattern required a unique alteration to the standard pattern. Usually a combination of techniques was used. This involved first merging as many pre-

altered pattern pieces as possible from various files into one file and then using the CAD patternmaking tools for additional alterations. For example, if a short-sleeved shirt order required a combination of a wider shoulder, a 2-inches-larger biceps, a 4-inches-smaller waist, and a 2-sizes-larger neck, then a new file would be created by the following procedure:

- A copy of the 415S_N2 Style File is made and is given the name of the soldier's surname.
- The sleeve pattern is deleted from the file.
- The sleeve pattern from 415S_B2 is merged into the file.
- The front and back patterns from 415S_WB are merged into the Style and renamed F and B.
- The shoulder, armcye, and side seam of each front are combined.
- The two fronts are positioned and locked together.
- The wide back shoulder, armcye, and side seam from pattern piece F are copied to the neck-altered front.
- Pattern piece F is deleted.
- The copied shoulder/armcye/side seam line is swapped for the original shoulder/armcye/side seam line.
- The wide shoulder procedure is repeated for the back.
- The waist is made smaller by the procedure described above with the exception that the space inside of the pattern is indicated as the side where the line is to be offset.
- The changes are stored.

The resulting pattern could conceivably be needed again for another order, but usually the combination of requirements was sufficiently unique, and the number of orders so small, that the decision was made not to keep track of these unique pattern configurations. Pattern files were retained only until the next regular "clean up" of the hard drive on which they were stored.

MEASUREMENT CHARTS AND ALTERATION GUIDES

The following Micromark Style Files have been prepared and used by Clemson Apparel Research to process Special Measurement orders for Standard Proportions and Pre-Altered Pattern Proportions. All are available in the full range of sizes in the Grade Rule and Synonym Tables.

Army Women's Shirts

SHORT SLEEVE

AWS Standard proportions

AWS_PB Plus bust, additional 2 inches in the bust on the front only

AWS_WB	Wide back, cross back 1 inch wider
AWS_B2	Biceps + 2 inches
AWS_B3	Biceps + 3 inches
AWS_B4	Biceps + 4 inches
AWS_B45	Biceps + 4.5 inches
AWS_N*	Neck * sizes larger than standard @ ¼ inch per size
LONG SLEEVE	
AWL	Standard proportions
AWL_PB	Plus bust, additional 2 inches in the bust on the front only
AWL_WB	Wide back, cross back 1 inch wider
AWL_B2	Biceps + 2 inches
AWL_B3	Biceps + 3 inches
AWL_B4	Biceps + 4 inches
AWL_B45	Biceps + 4.5 inches
AWL_S1	Sleeve length + 1 inch
AWL_S2	Sleeve length + 2 inches
AWL_S4	Sleeve length + 4 inches
AWL_S5	Sleeve length + 5 inches
AWL_N*	Neck * sizes larger than standard @ ¼ inch per size

Army Men's Shirts

SHORT SLEEVE

AMS	Standard proportions
AMS_2	Length plus 2 inches with waist curve 1 inch lower

AMS_4	Length plus 4 inches with waist curve 2 inches lower and one additional button
AMS_6	Length plus 6 inches with waist curve 3 inches lower and one additional button
AMS_8	Length plus 8 inches with waist curve 4 inches lower and two additional buttons
AMS_WB	Wide back, cross back 1 inch wider
AMS_BB	Body builder, cross back 1 inch wider, high chest 2 inches larger, armcye ½ inch deeper, biceps 1 ½ inches wider, waist and sweep 4 inches smaller
AMS_P	Plus, waist 5 ½ inches larger
AMS_X	Extra plus, waist 6 ½ inches larger, sweep 3 inches larger
AMS_N*	Neck * sizes larger than standard @ ½ inch per size

Army Men's Shirts

LONG SLEEVE

AML	Standard proportions
AML_2	Length plus 2 inches with waist curve 1 inch lower
AML_4	Length plus 4 inches with waist curve 2 inches lower and one additional button
AML_6	Length plus 6 inches with waist curve 3 inches lower and one additional button
AML_8	Length plus 8 inches with waist curve 4 inches lower and two additional buttons
AML_WB	Wide back, cross back 1 inch wider
AML_BB	Body builder, cross back 1 inch wider, high chest 2 inches larger, armcye ½ inch deeper, biceps 1 ½ inches wider, waist and sweep 4 inches smaller
AML_P	Plus, waist 5 ½ inches larger
AML_X	Extra plus, waist 6 ½ inches larger, sweep 3 inches larger
AML_N*	Neck * sizes larger than standard @ ½ inch per size

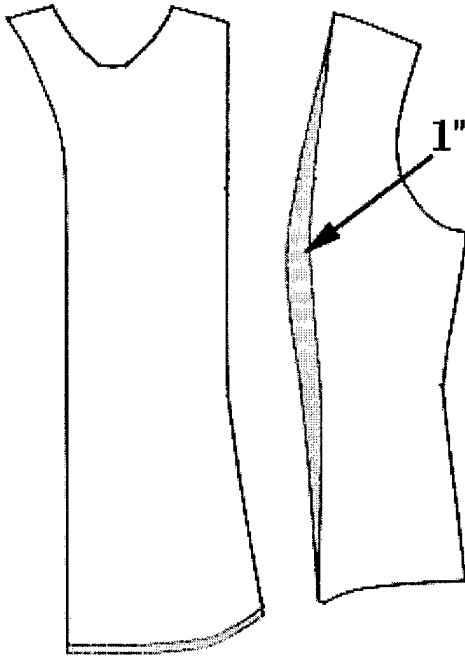
Women's AG415 Shirt Garment Dimensions Standard

	Size 4	Size 6	Size 8	Size 10	Size 12	Size 14
Bust	39.250	40.250	41.250	42.250	43.250	44.750
Waist	34.000	35.000	36.000	37.000	38.000	39.500
Sweep	42.000	43.000	44.000	45.000	46.000	47.500
Back waist length	15.500	15.625	15.750	15.875	16.000	16.125
Cross shoulder	15.75	16.125	16.500	16.875	17.375	17.875
Biceps	13.375	13.750	14.000	14.375	14.750	15.125
Sleeve length from CB S	29.625	29.625	29.625	29.750	29.750	29.750
Sleeve length from CB R	31.125	31.125	31.125	31.250	31.250	31.250
Sleeve length from CB L	32.625	32.625	32.625	32.750	32.750	32.750
Sleeve length from CB XL	34.125	34.125	34.125	34.250	34.250	34.250
Sleeve length from CB XXL	35.625	35.625	35.625	35.750	35.750	35.750
Neck circumference	12.500	12.750	13.000	13.250	13.500	13.750

	Size 16	Size 18	Size 20	Size 22	Size 24	Size 26
Bust	46.250	48.250	50.250	52.250	54.250	56.250
Waist	41.000	43.000	45.000	47.000	49.000	51.000
Sweep	49.000	51.000	53.000	55.000	57.000	59.000
Back waist length	16.250	16.375	16.500	16.625	16.750	16.875
Cross shoulder	18.375	18.875	19.500	20.000	20.625	21.125
Biceps	15.500	16.000	16.500	16.875	17.250	17.750
Sleeve length from CB S	29.750	29.750	29.750	29.750	29.750	29.750
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750	35.750
Neck circumference	14.000	14.250	14.500	14.750	15.000	15.250

	Size 28	Size 30	Size 32	Size 34	Size 36
Bust	58.250	60.250	62.250	64.250	66.250
Waist	53.000	55.000	57.000	59.000	61.000
Sweep	61.000	63.000	65.000	67.000	69.000
Back waist length	17.000	17.125	17.250	17.375	17.500
Cross shoulder	21.750	22.375	22.875	23.375	23.875
Biceps	18.125	18.500	18.875	19.375	19.875
Sleeve length from CB S	31.125	31.125	31.125	31.125	31.125
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750
Neck circumference	15.500	15.750	16.000	16.250	16.500

AWL_PB and AWS_PB



All alterations were made to the sew lines. The recognized boundary was switched to the sew lines, the alteration was made, the recognized boundary was changed back to the cut lines.

The plus bust requires extra length and width. For this style garment the additional width was added to the side front. The length of the "princess seam" sew line was measured and recorded. The additional width was added. The length of the revised sew line was measured. The difference between the old sew line and the new sew line lengths was added to the hem of the center front panel so that the "princess seam" sew lines would match.

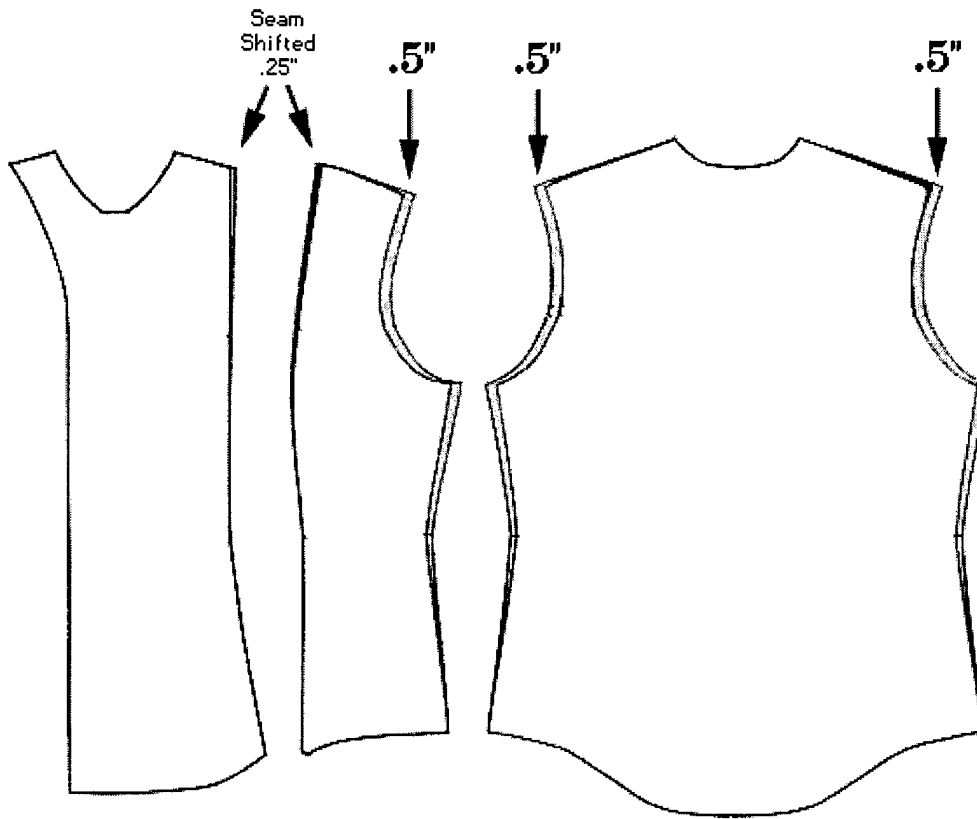
Women's AG415 Shirt Garment Dimensions Plus Bust

	Size 4	Size 6	Size 8	Size 10	Size 12	Size 14
Bust	41.250	42.250	43.250	44.250	45.250	46.750
Waist	35.750	36.750	37.750	38.750	39.750	41.250
Sweep	42.000	43.000	44.000	45.000	46.000	47.500
Back waist length	15.500	15.625	15.750	15.875	16.000	16.125
Cross shoulder	15.75	16.125	16.500	16.875	17.375	17.875
Biceps	13.375	13.750	14.000	14.375	14.750	15.125
Sleeve length from CB S	29.625	29.625	29.625	29.750	29.750	29.750
Sleeve length from CB R	31.125	31.125	31.125	31.250	31.250	31.250
Sleeve length from CB L	32.625	32.625	32.625	32.750	32.750	32.750
Sleeve length from CB XL	34.125	34.125	34.125	34.250	34.250	34.250
Sleeve length from CB XXL	35.625	35.625	35.625	35.750	35.750	35.750
Neck circumference	12.500	12.750	13.000	13.250	13.500	13.750

	Size 16	Size 18	Size 20	Size 22	Size 24	Size 26
Bust	48.250	50.250	52.250	54.250	56.250	58.250
Waist	42.750	44.750	46.750	48.750	50.750	52.750
Sweep	49.000	51.000	53.000	55.000	57.000	59.000
Back waist length	16.250	16.375	16.500	16.625	16.750	16.875
Cross shoulder	18.375	18.875	19.500	20.000	20.625	21.125
Biceps	15.500	16.000	16.500	16.875	17.250	17.750
Sleeve length from CB S	29.750	29.750	29.750	29.750	29.750	29.750
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750	35.750
Neck circumference	14.000	14.250	14.500	14.750	15.000	15.250

	Size 28	Size 30	Size 32	Size 34	Size 36
Bust	60.250	62.250	64.250	66.250	68.250
Waist	54.750	56.750	58.750	60.750	62.750
Sweep	61.000	63.000	65.000	67.000	69.000
Back waist length	17.000	17.125	17.250	17.375	17.500
Cross shoulder	21.750	22.375	22.875	23.375	23.875
Biceps	18.125	18.500	18.875	19.375	19.875
Sleeve length from CB S	31.125	31.125	31.125	31.125	31.125
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750
Neck circumference	15.500	15.750	16.000	16.250	16.500

AWL_WB and AWS_WB



Additions are indicated in yellow, deletion is in red.

The shoulder, armcye, and side seam edges were shifted .5" away from the original. The side seam at hem was blended back to the original. The "princess" seam at the shoulder was shifted .25" toward the shoulder. The "princess" seam was blended back to the original at the bust level.

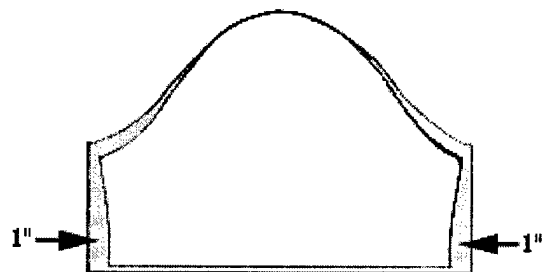
Women's AG415 Shirt Garment Dimensions Wide Back

	Size 4	Size 6	Size 8	Size 10	Size 12	Size 14
Bust	39.250	40.250	41.250	42.250	43.250	44.750
Waist	35.000	36.000	37.000	38.000	39.000	40.500
Sweep	42.000	43.000	44.000	45.000	46.000	47.500
Back waist length	15.500	15.625	15.750	15.875	16.000	16.125
Cross shoulder	16.750	17.125	17.500	17.875	18.375	18.875
Biceps	13.375	13.750	14.000	14.375	14.750	15.125
Sleeve length from CB S	29.625	29.625	29.625	29.750	29.750	29.750
Sleeve length from CB R	31.125	31.125	31.125	31.250	31.250	31.250
Sleeve length from CB L	32.625	32.625	32.625	32.750	32.750	32.750
Sleeve length from CB XL	34.125	34.125	34.125	34.250	34.250	34.250
Sleeve length from CB XXL	35.625	35.625	35.625	35.750	35.750	35.750
Neck circumference	12.500	12.750	13.000	13.250	13.500	13.750

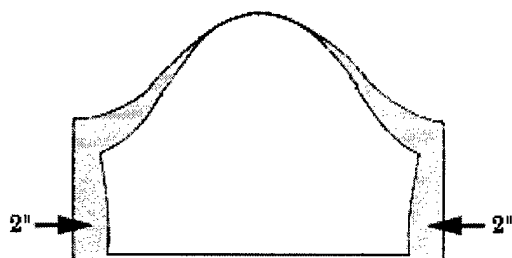
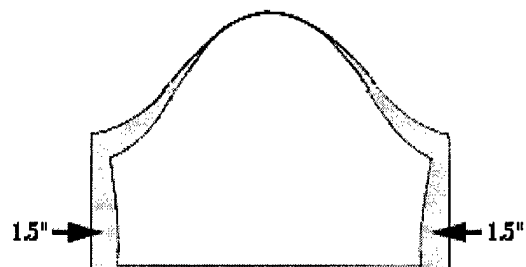
	Size 16	Size 18	Size 20	Size 22	Size 24	Size 26
Bust	46.250	48.250	50.250	52.250	54.250	56.250
Waist	42.000	44.000	46.000	48.000	50.000	52.000
Sweep	49.000	51.000	53.000	55.000	57.000	59.000
Back waist length	16.250	16.375	16.500	16.625	16.750	16.875
Cross shoulder	19.375	19.875	20.500	21.000	21.625	22.125
Biceps	15.500	16.000	16.500	16.875	17.250	17.750
Sleeve length from CB S	29.750	29.750	29.750	29.750	29.750	29.750
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750	35.750
Neck circumference	14.000	14.250	14.500	14.750	15.000	15.250

	Size 28	Size 30	Size 32	Size 34	Size 36
Bust	58.250	60.250	62.250	64.250	66.250
Waist	54.000	56.000	58.000	60.000	62.000
Sweep	61.000	63.000	65.000	67.000	69.000
Back waist length	17.000	17.125	17.250	17.375	17.500
Cross shoulder	22.750	23.375	23.875	24.375	24.875
Biceps	18.125	18.500	18.875	19.375	19.875
Sleeve length from CB S	31.125	31.125	31.125	31.125	31.125
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750
Neck circumference	15.500	15.750	16.000	16.250	16.500

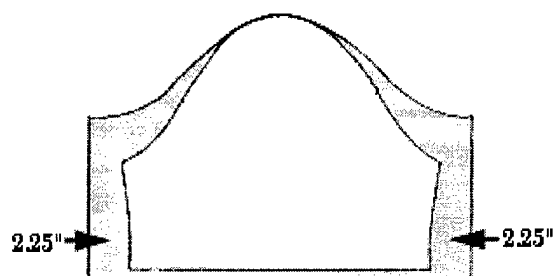
AWS_B2



AWS_B3



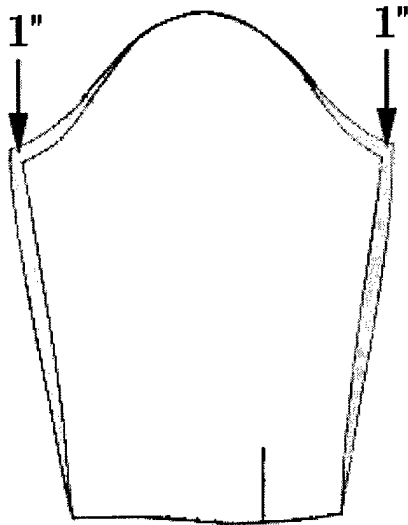
AWS_B4



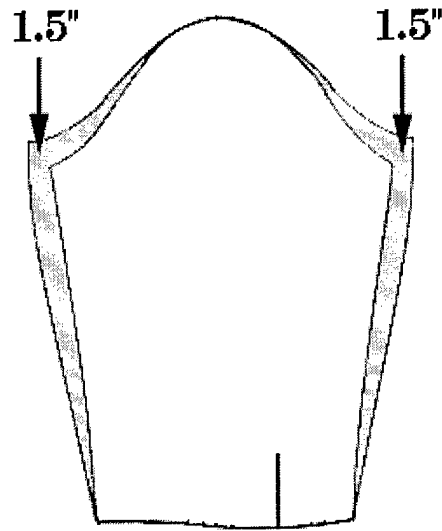
AWS_B45

The biceps modification is accomplished by making the high, fitted sleeve into a more "action" sleeve. This retains the cap seam length to fit the armcye, while increasing the biceps and lengthening the undersleeve seam.

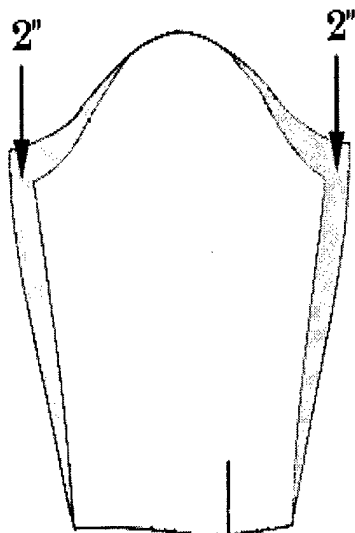
AWL_B2



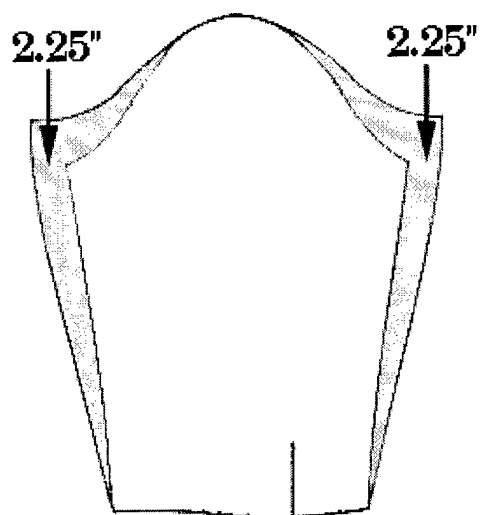
AWL_B3



AWL_B4



AWL_B45



The biceps modification is accomplished by making the high, fitted sleeve into a more "action" sleeve. This retains the cap seam length to fit the armcye, while increasing the biceps and lengthening the undersleeve seam.

Women's AG415 Shirt Garment Dimensions

Biceps + 2

	Size 4	Size 6	Size 8	Size 10	Size 12	Size 14
Bust	39.250	40.250	41.250	42.250	43.250	44.750
Waist	34.000	35.000	36.000	37.000	38.000	39.500
Sweep	42.000	43.000	44.000	45.000	46.000	47.500
Back waist length	15.500	15.625	15.750	15.875	16.000	16.125
Cross shoulder	15.75	16.125	16.500	16.875	17.375	17.875
Biceps	15.375	15.750	16.000	16.375	16.750	17.125
Sleeve length from CB S	29.625	29.625	29.625	29.750	29.750	29.750
Sleeve length from CB R	31.125	31.125	31.125	31.250	31.250	31.250
Sleeve length from CB L	32.625	32.625	32.625	32.750	32.750	32.750
Sleeve length from CB XL	34.125	34.125	34.125	34.250	34.250	34.250
Sleeve length from CB XXL	35.625	35.625	35.625	35.750	35.750	35.750
Neck circumference	12.500	12.750	13.000	13.250	13.500	13.750

	Size 16	Size 18	Size 20	Size 22	Size 24	Size 26
Bust	46.250	48.250	50.250	52.250	54.250	56.250
Waist	41.000	43.000	45.000	47.000	49.000	51.000
Sweep	49.000	51.000	53.000	55.000	57.000	59.000
Back waist length	16.250	16.375	16.500	16.625	16.750	16.875
Cross shoulder	18.375	18.875	19.500	20.000	20.625	21.125
Biceps	17.500	18.000	18.500	18.875	19.250	19.750
Sleeve length from CB S	29.750	29.750	29.750	29.750	29.750	29.750
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750	35.750
Neck circumference	14.000	14.250	14.500	14.750	15.000	15.250

	Size 28	Size 30	Size 32	Size 34	Size 36
Bust	58.250	60.250	62.250	64.250	66.250
Waist	53.000	55.000	57.000	59.000	61.000
Sweep	61.000	63.000	65.000	67.000	69.000
Back waist length	17.000	17.125	17.250	17.375	17.500
Cross shoulder	21.750	22.375	22.875	23.375	23.875
Biceps	20.125	20.500	20.875	21.375	21.875
Sleeve length from CB S	31.125	31.125	31.125	31.125	31.125
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750
Neck circumference	15.500	15.750	16.000	16.250	16.500

Women's AG415 Shirt Garment Dimensions

Biceps + 3

	Size 4	Size 6	Size 8	Size 10	Size 12	Size 14
Bust	39.250	40.250	41.250	42.250	43.250	44.750
Waist	34.000	35.000	36.000	37.000	38.000	39.500
Sweep	42.000	43.000	44.000	45.000	46.000	47.500
Back waist length	15.500	15.625	15.750	15.875	16.000	16.125
Cross shoulder	15.75	16.125	16.500	16.875	17.375	17.875
Biceps	16.375	16.750	17.000	17.375	17.750	18.125
Sleeve length from CB S	29.625	29.625	29.625	29.750	29.750	29.750
Sleeve length from CB R	31.125	31.125	31.125	31.250	31.250	31.250
Sleeve length from CB L	32.625	32.625	32.625	32.750	32.750	32.750
Sleeve length from CB XL	34.125	34.125	34.125	34.250	34.250	34.250
Sleeve length from CB XXL	35.625	35.625	35.625	35.750	35.750	35.750
Neck circumference	12.500	12.750	13.000	13.250	13.500	13.750

	Size 16	Size 18	Size 20	Size 22	Size 24	Size 26
Bust	46.250	48.250	50.250	52.250	54.250	56.250
Waist	41.000	43.000	45.000	47.000	49.000	51.000
Sweep	49.000	51.000	53.000	55.000	57.000	59.000
Back waist length	16.250	16.375	16.500	16.625	16.750	16.875
Cross shoulder	18.375	18.875	19.500	20.000	20.625	21.125
Biceps	18.500	19.000	19.500	19.875	20.250	20.750
Sleeve length from CB S	29.750	29.750	29.750	29.750	29.750	29.750
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750	35.750
Neck circumference	14.000	14.250	14.500	14.750	15.000	15.250

	Size 28	Size 30	Size 32	Size 34	Size 36
Bust	58.250	60.250	62.250	64.250	66.250
Waist	53.000	55.000	57.000	59.000	61.000
Sweep	61.000	63.000	65.000	67.000	69.000
Back waist length	17.000	17.125	17.250	17.375	17.500
Cross shoulder	21.750	22.375	22.875	23.375	23.875
Biceps	21.125	21.500	21.875	22.375	22.875
Sleeve length from CB S	31.125	31.125	31.125	31.125	31.125
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750
Neck circumference	15.500	15.750	16.000	16.250	16.500

Women's AG415 Shirt Garment Dimensions

Biceps + 4

	Size 4	Size 6	Size 8	Size 10	Size 12	Size 14
Bust	39.250	40.250	41.250	42.250	43.250	44.750
Waist	34.000	35.000	36.000	37.000	38.000	39.500
Sweep	42.000	43.000	44.000	45.000	46.000	47.500
Back waist length	15.500	15.625	15.750	15.875	16.000	16.125
Cross shoulder	15.75	16.125	16.500	16.875	17.375	17.875
Biceps	17.375	17.750	18.000	18.375	18.750	19.125
Sleeve length from CB S	29.625	29.625	29.625	29.750	29.750	29.750
Sleeve length from CB R	31.125	31.125	31.125	31.250	31.250	31.250
Sleeve length from CB L	32.625	32.625	32.625	32.750	32.750	32.750
Sleeve length from CB XL	34.125	34.125	34.125	34.250	34.250	34.250
Sleeve length from CB XXL	35.625	35.625	35.625	35.750	35.750	35.750
Neck circumference	12.500	12.750	13.000	13.250	13.500	13.750

	Size 16	Size 18	Size 20	Size 22	Size 24	Size 26
Bust	46.250	48.250	50.250	52.250	54.250	56.250
Waist	41.000	43.000	45.000	47.000	49.000	51.000
Sweep	49.000	51.000	53.000	55.000	57.000	59.000
Back waist length	16.250	16.375	16.500	16.625	16.750	16.875
Cross shoulder	18.375	18.875	19.500	20.000	20.625	21.125
Biceps	19.500	20.000	20.500	20.875	21.250	21.750
Sleeve length from CB S	29.750	29.750	29.750	29.750	29.750	29.750
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750	35.750
Neck circumference	14.000	14.250	14.500	14.750	15.000	15.250

	Size 28	Size 30	Size 32	Size 34	Size 36
Bust	58.250	60.250	62.250	64.250	66.250
Waist	53.000	55.000	57.000	59.000	61.000
Sweep	61.000	63.000	65.000	67.000	69.000
Back waist length	17.000	17.125	17.250	17.375	17.500
Cross shoulder	21.750	22.375	22.875	23.375	23.875
Biceps	22.125	22.500	22.875	23.375	23.875
Sleeve length from CB S	31.125	31.125	31.125	31.125	31.125
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750
Neck circumference	15.500	15.750	16.000	16.250	16.500

Women's AG415 Shirt Garment Dimensions

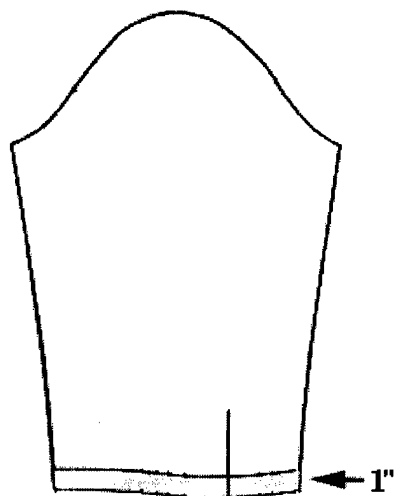
Biceps + 4.5

	Size 4	Size 6	Size 8	Size 10	Size 12	Size 14
Bust	39.250	40.250	41.250	42.250	43.250	44.750
Waist	34.000	35.000	36.000	37.000	38.000	39.500
Sweep	42.000	43.000	44.000	45.000	46.000	47.500
Back waist length	15.500	15.625	15.750	15.875	16.000	16.125
Cross shoulder	15.75	16.125	16.500	16.875	17.375	17.875
Biceps	17.875	18.250	18.500	18.875	19.250	19.625
Sleeve length from CB S	29.625	29.625	29.625	29.750	29.750	29.750
Sleeve length from CB R	31.125	31.125	31.125	31.250	31.250	31.250
Sleeve length from CB L	32.625	32.625	32.625	32.750	32.750	32.750
Sleeve length from CB XL	34.125	34.125	34.125	34.250	34.250	34.250
Sleeve length from CB XXL	35.625	35.625	35.625	35.750	35.750	35.750
Neck circumference	12.500	12.750	13.000	13.250	13.500	13.750

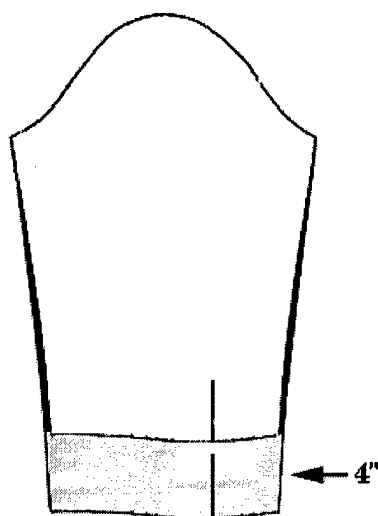
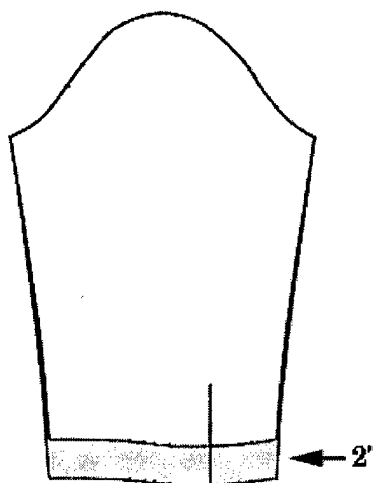
	Size 16	Size 18	Size 20	Size 22	Size 24	Size 26
Bust	46.250	48.250	50.250	52.250	54.250	56.250
Waist	41.000	43.000	45.000	47.000	49.000	51.000
Sweep	49.000	51.000	53.000	55.000	57.000	59.000
Back waist length	16.250	16.375	16.500	16.625	16.750	16.875
Cross shoulder	18.375	18.875	19.500	20.000	20.625	21.125
Biceps	20.000	20.500	21.000	21.375	21.750	22.250
Sleeve length from CB S	29.750	29.750	29.750	29.750	29.750	29.750
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750	35.750
Neck circumference	14.000	14.250	14.500	14.750	15.000	15.250

	Size 28	Size 30	Size 32	Size 34	Size 36
Bust	58.250	60.250	62.250	64.250	66.250
Waist	53.000	55.000	57.000	59.000	61.000
Sweep	61.000	63.000	65.000	67.000	69.000
Back waist length	17.000	17.125	17.250	17.375	17.500
Cross shoulder	21.750	22.375	22.875	23.375	23.875
Biceps	22.625	23.000	23.375	23.875	24.375
Sleeve length from CB S	31.125	31.125	31.125	31.125	31.125
Sleeve length from CB R	31.250	31.250	31.250	31.250	31.250
Sleeve length from CB L	32.750	32.750	32.750	32.750	32.750
Sleeve length from CB XL	34.250	34.250	34.250	34.250	34.250
Sleeve length from CB XXL	35.750	35.750	35.750	35.750	35.750
Neck circumference	15.500	15.750	16.000	16.250	16.500

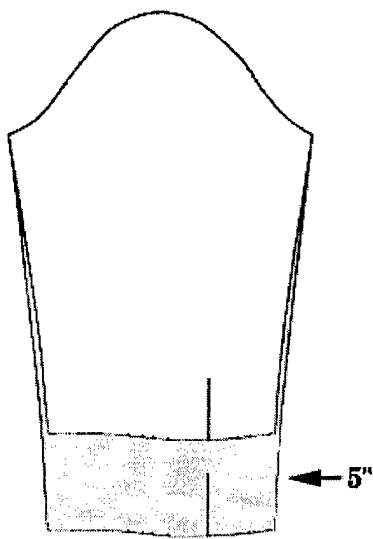
AWL_S1



AWL_S2



AWL_S4



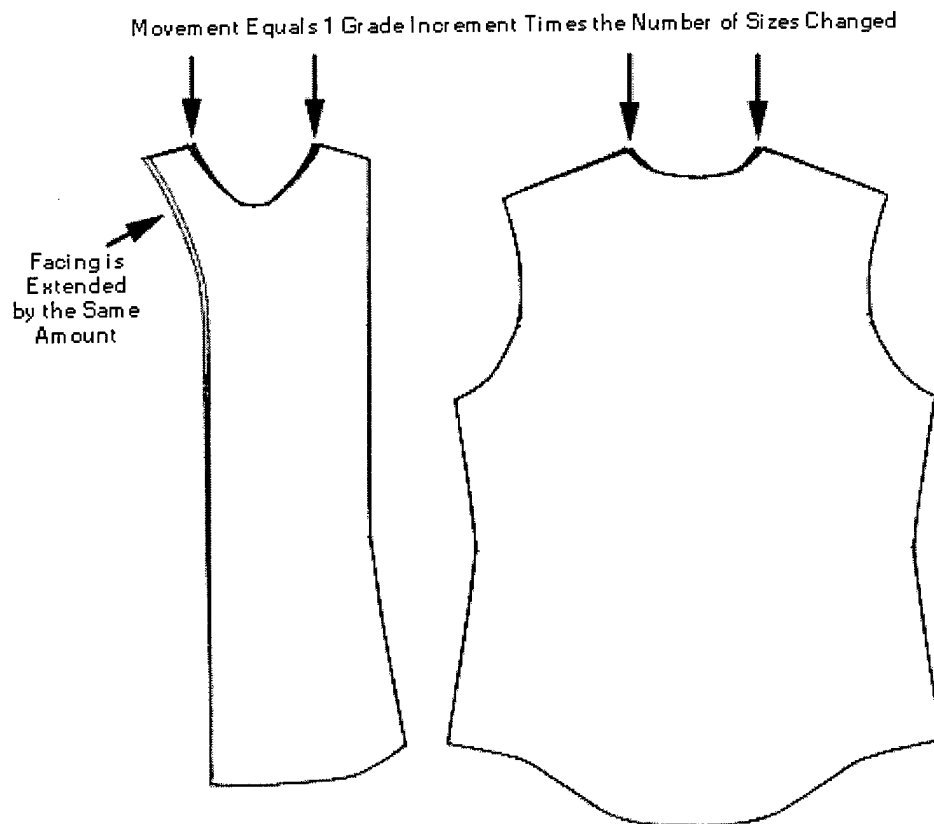
AWL_S5

The wrist edge (including the placket opening) was shifted away from the original in the amount desired. The undersleeve seam edges were blended to match the original.

No measurement chart is provided for these modifications because there are so many possibilities. The proportional sizes S, R, L, XL, and XXL provide 1.5 inch increments in sleeve length. The above modifications provide for intermediate sleeve lengths.

AWL_N4 and AWS_N4

Illustration is for N4, instructions are generic.



Additions are indicated in yellow; deletions are in red.

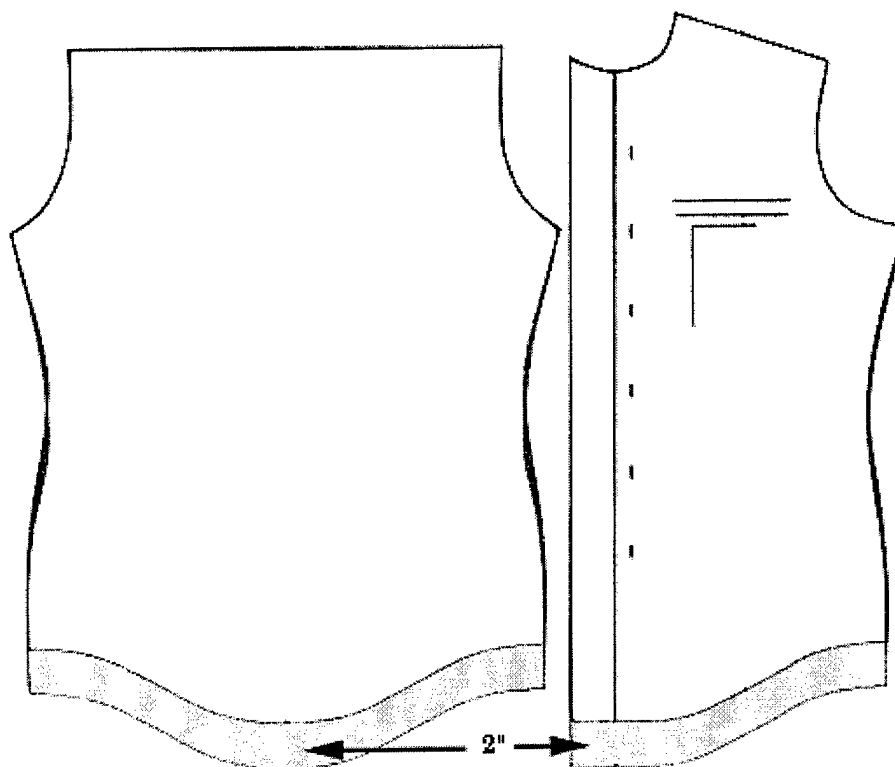
The grade increment per size is determined. The increment is multiplied by the number of sizes to be changed. The neck/shoulder point is moved by the amount of the total increment and blended to the center front on the garment and the facing. The shoulder/outer edge point of the facing is moved by the same amount.

No measurement chart is provided for this modification. The grade increment for the neck is $\frac{1}{4}$ inch per size. To determine the neck measurement, multiply $\frac{1}{4}$ by the number of neck sizes added. In the above sample the neck size in the standard chart would increase by 4 times $\frac{1}{4}$ inch or 1 inch. Add 1 inch to the neck measurement in the standard chart.

**Men's AG415 Shirt Garment Dimensions
Standard**

Size	Chest	Waist	Sweep	Cross Back	Biceps	Length
13	38.00	31.50	35.25	15.25	14.50	30.25
13.5	40.00	33.50	37.25	16.00	15.00	30.50
14	42.00	35.50	39.25	16.75	15.50	30.75
14.5	44.00	37.50	41.25	17.50	16.00	31.00
15	46.00	39.50	43.25	18.25	16.50	31.25
15.5	48.00	41.50	45.25	19.00	17.00	31.50
16	50.00	43.50	47.25	19.75	17.50	31.75
16.5	52.00	45.50	49.25	20.50	18.00	32.00
17	54.00	47.50	51.25	21.25	18.50	32.25
17.5	56.00	49.50	53.25	22.00	19.00	32.50
18	58.00	51.50	55.25	22.75	19.50	32.75
18.5	60.00	53.50	57.25	23.50	20.00	33.00
19	62.00	55.50	59.25	24.25	20.50	33.25
19.5	64.00	57.50	61.25	25.00	21.00	33.50
20	66.00	59.50	63.25	25.75	21.50	33.75
20.5	68.00	61.50	65.25	26.50	22.00	34.00
21	70.00	63.50	67.25	27.25	22.50	34.25
21.5	72.00	65.50	69.25	28.00	23.00	34.50
22	74.00	67.50	71.25	28.75	23.50	34.75
22.5	76.00	69.50	73.25	29.50	24.00	35.00
23	78.00	71.50	75.25	30.25	24.50	35.25

AMS_2 and AMS_2



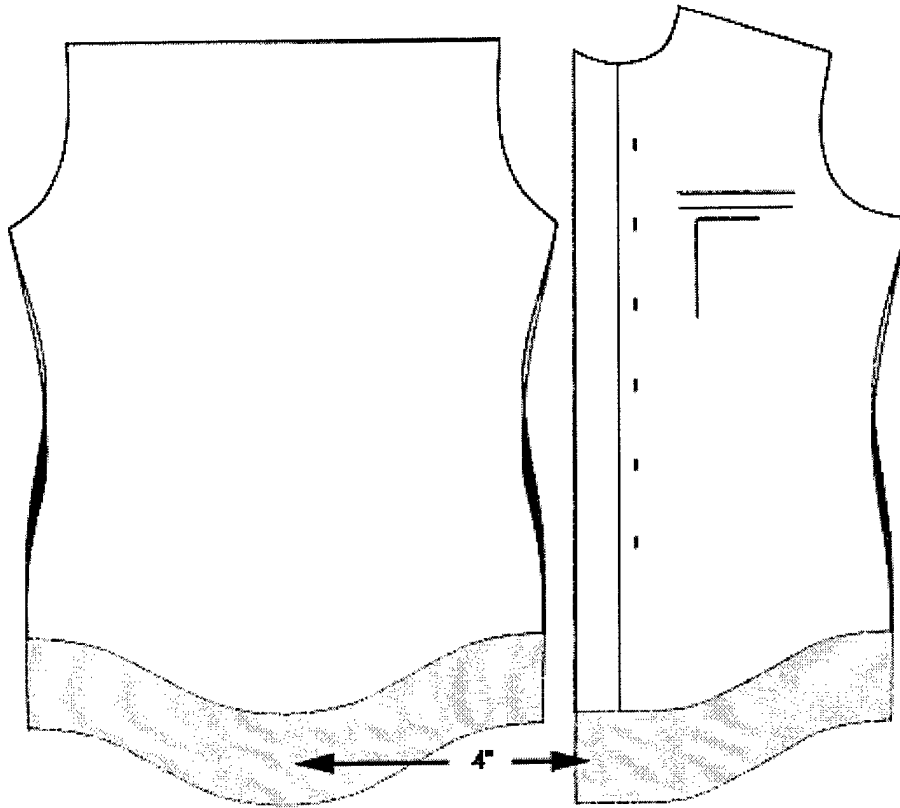
Additions are indicated in yellow; deletions are in red.

The hem is shifted 2 inches and the deepest part of the waistline curve is shifted 1 inch.

Men's AG415 Shirt Garment Dimensions
Length + 2

Size	Chest	Waist	Sweep	Cross Back	Biceps	Length
13	38.00	31.50	35.25	15.25	14.50	32.25
13.5	40.00	33.50	37.25	16.00	15.00	32.50
14	42.00	35.50	39.25	16.75	15.50	32.75
14.5	44.00	37.50	41.25	17.50	16.00	33.00
15	46.00	39.50	43.25	18.25	16.50	33.25
15.5	48.00	41.50	45.25	19.00	17.00	33.50
16	50.00	43.50	47.25	19.75	17.50	33.75
16.5	52.00	45.50	49.25	20.50	18.00	34.00
17	54.00	47.50	51.25	21.25	18.50	34.25
17.5	56.00	49.50	53.25	22.00	19.00	34.50
18	58.00	51.50	55.25	22.75	19.50	34.75
18.5	60.00	53.50	57.25	23.50	20.00	35.00
19	62.00	55.50	59.25	24.25	20.50	35.25
19.5	64.00	57.50	61.25	25.00	21.00	35.50
20	66.00	59.50	63.25	25.75	21.50	35.75
20.5	68.00	61.50	65.25	26.50	22.00	36.00
21	70.00	63.50	67.25	27.25	22.50	36.25
21.5	72.00	65.50	69.25	28.00	23.00	36.50
22	74.00	67.50	71.25	28.75	23.50	36.75
22.5	76.00	69.50	73.25	29.50	24.00	37.00
23	78.00	71.50	75.25	30.25	24.50	37.25

AMS_4 and AML_4



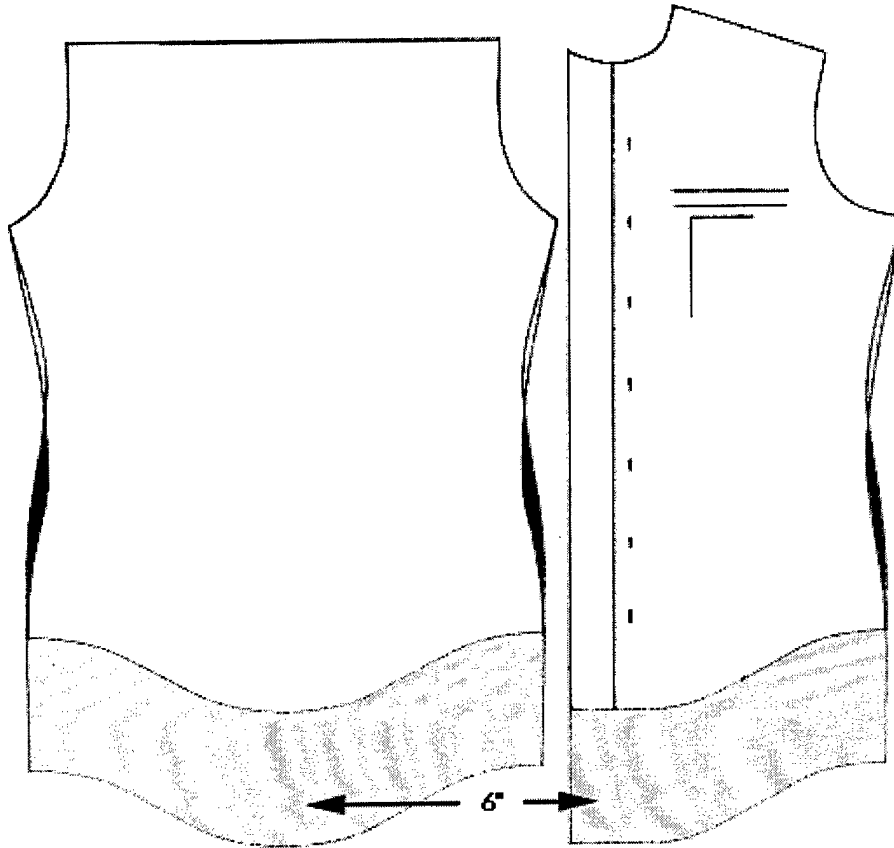
Additions are indicated in yellow; deletions are in red.

The hem is shifted 4 inches and the deepest part of the waistline curve is shifted 2 inches.
One button is added.

Men's AG415 Shirt Garment Dimensions
Length + 4

Size	Chest	Waist	Sweep	Cross Back	Biceps	Length
13	38.00	31.50	35.25	15.25	14.50	34.25
13.5	40.00	33.50	37.25	16.00	15.00	34.50
14	42.00	35.50	39.25	16.75	15.50	34.75
14.5	44.00	37.50	41.25	17.50	16.00	35.00
15	46.00	39.50	43.25	18.25	16.50	35.25
15.5	48.00	41.50	45.25	19.00	17.00	35.50
16	50.00	43.50	47.25	19.75	17.50	35.75
16.5	52.00	45.50	49.25	20.50	18.00	36.00
17	54.00	47.50	51.25	21.25	18.50	36.25
17.5	56.00	49.50	53.25	22.00	19.00	36.50
18	58.00	51.50	55.25	22.75	19.50	36.75
18.5	60.00	53.50	57.25	23.50	20.00	37.00
19	62.00	55.50	59.25	24.25	20.50	37.25
19.5	64.00	57.50	61.25	25.00	21.00	37.50
20	66.00	59.50	63.25	25.75	21.50	37.75
20.5	68.00	61.50	65.25	26.50	22.00	38.00
21	70.00	63.50	67.25	27.25	22.50	38.25
21.5	72.00	65.50	69.25	28.00	23.00	38.50
22	74.00	67.50	71.25	28.75	23.50	38.75
22.5	76.00	69.50	73.25	29.50	24.00	39.00
23	78.00	71.50	75.25	30.25	24.50	39.25

AMS_6 and AML_6



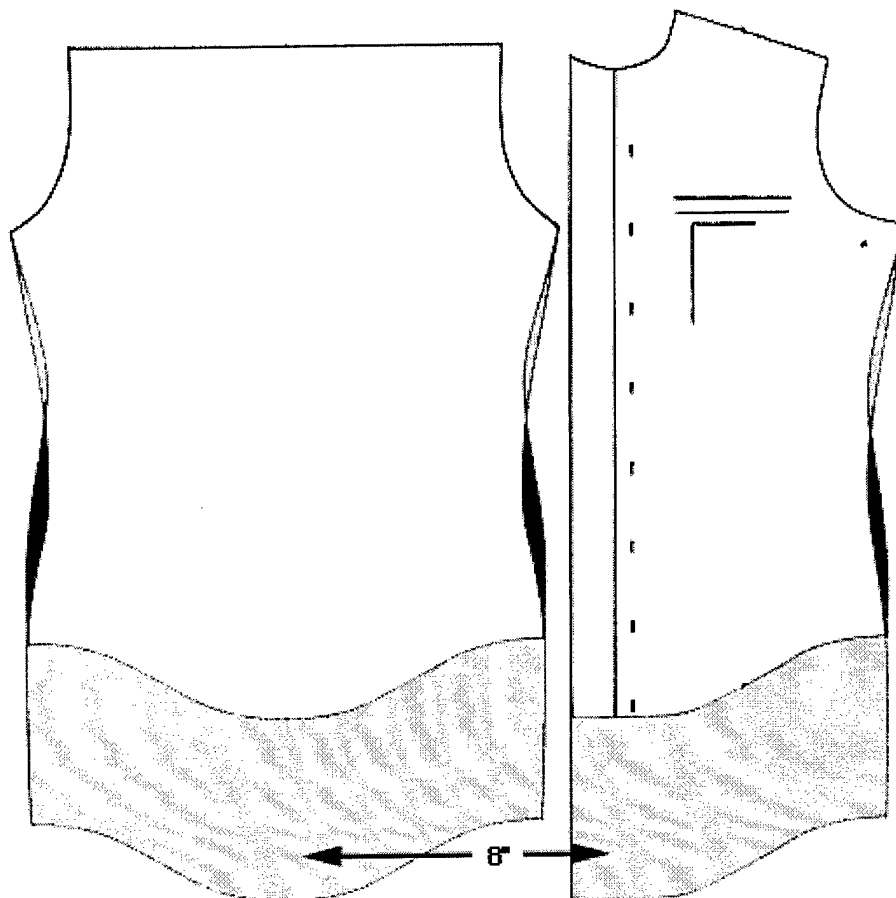
Additions are indicated in yellow; deletions are in red.

The hem is shifted 6 inches and the deepest part of the waistline curve is shifted 3 inches.
One button is added.

Men's AG415 Shirt Garment Dimensions
Length + 6

Size	Chest	Waist	Sweep	Cross Back	Biceps	Length
13	38.00	31.50	35.25	15.25	14.50	36.25
13.5	40.00	33.50	37.25	16.00	15.00	36.50
14	42.00	35.50	39.25	16.75	15.50	36.75
14.5	44.00	37.50	41.25	17.50	16.00	37.00
15	46.00	39.50	43.25	18.25	16.50	37.25
15.5	48.00	41.50	45.25	19.00	17.00	37.50
16	50.00	43.50	47.25	19.75	17.50	37.75
16.5	52.00	45.50	49.25	20.50	18.00	38.00
17	54.00	47.50	51.25	21.25	18.50	38.25
17.5	56.00	49.50	53.25	22.00	19.00	38.50
18	58.00	51.50	55.25	22.75	19.50	38.75
18.5	60.00	53.50	57.25	23.50	20.00	39.00
19	62.00	55.50	59.25	24.25	20.50	39.25
19.5	64.00	57.50	61.25	25.00	21.00	39.50
20	66.00	59.50	63.25	25.75	21.50	39.75
20.5	68.00	61.50	65.25	26.50	22.00	40.00
21	70.00	63.50	67.25	27.25	22.50	40.25
21.5	72.00	65.50	69.25	28.00	23.00	40.50
22	74.00	67.50	71.25	28.75	23.50	40.75
22.5	76.00	69.50	73.25	29.50	24.00	41.00
23	78.00	71.50	75.25	30.25	24.50	41.25

AMS_8 and AML_8



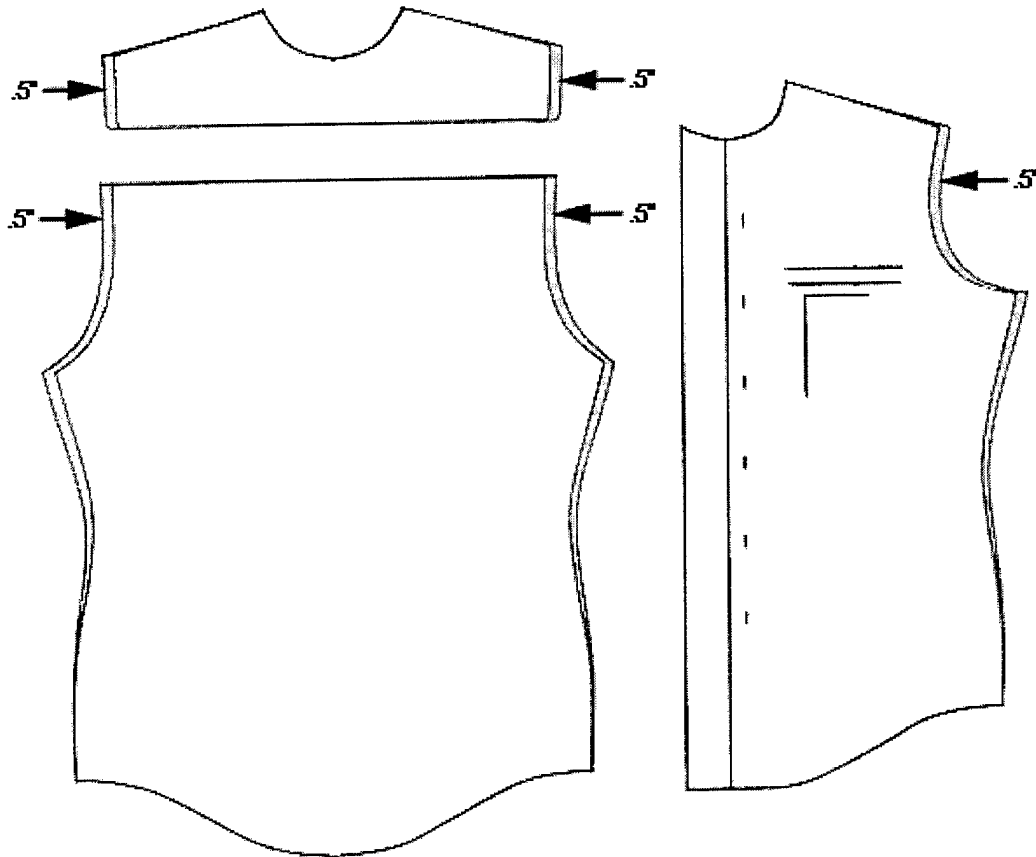
Additions are indicated in yellow; deletions are in red.

The hem is shifted 8 inches and the deepest part of the waistline curve is shifted 4 inches.
Two buttons are added.

Men's AG415 Shirt Garment Dimensions
Length + 8

Size	Chest	Waist	Sweep	Cross Back	Biceps	Length
13	38.00	31.50	35.25	15.25	14.50	38.25
13.5	40.00	33.50	37.25	16.00	15.00	38.50
14	42.00	35.50	39.25	16.75	15.50	38.75
14.5	44.00	37.50	41.25	17.50	16.00	39.00
15	46.00	39.50	43.25	18.25	16.50	39.25
15.5	48.00	41.50	45.25	19.00	17.00	39.50
16	50.00	43.50	47.25	19.75	17.50	39.75
16.5	52.00	45.50	49.25	20.50	18.00	40.00
17	54.00	47.50	51.25	21.25	18.50	40.25
17.5	56.00	49.50	53.25	22.00	19.00	40.50
18	58.00	51.50	55.25	22.75	19.50	40.75
18.5	60.00	53.50	57.25	23.50	20.00	41.00
19	62.00	55.50	59.25	24.25	20.50	41.25
19.5	64.00	57.50	61.25	25.00	21.00	41.50
20	66.00	59.50	63.25	25.75	21.50	41.75
20.5	68.00	61.50	65.25	26.50	22.00	42.00
21	70.00	63.50	67.25	27.25	22.50	42.25
21.5	72.00	65.50	69.25	28.00	23.00	42.50
22	74.00	67.50	71.25	28.75	23.50	42.75
22.5	76.00	69.50	73.25	29.50	24.00	43.00
23	78.00	71.50	75.25	30.25	24.50	43.25

AMS_WB and AML_WB

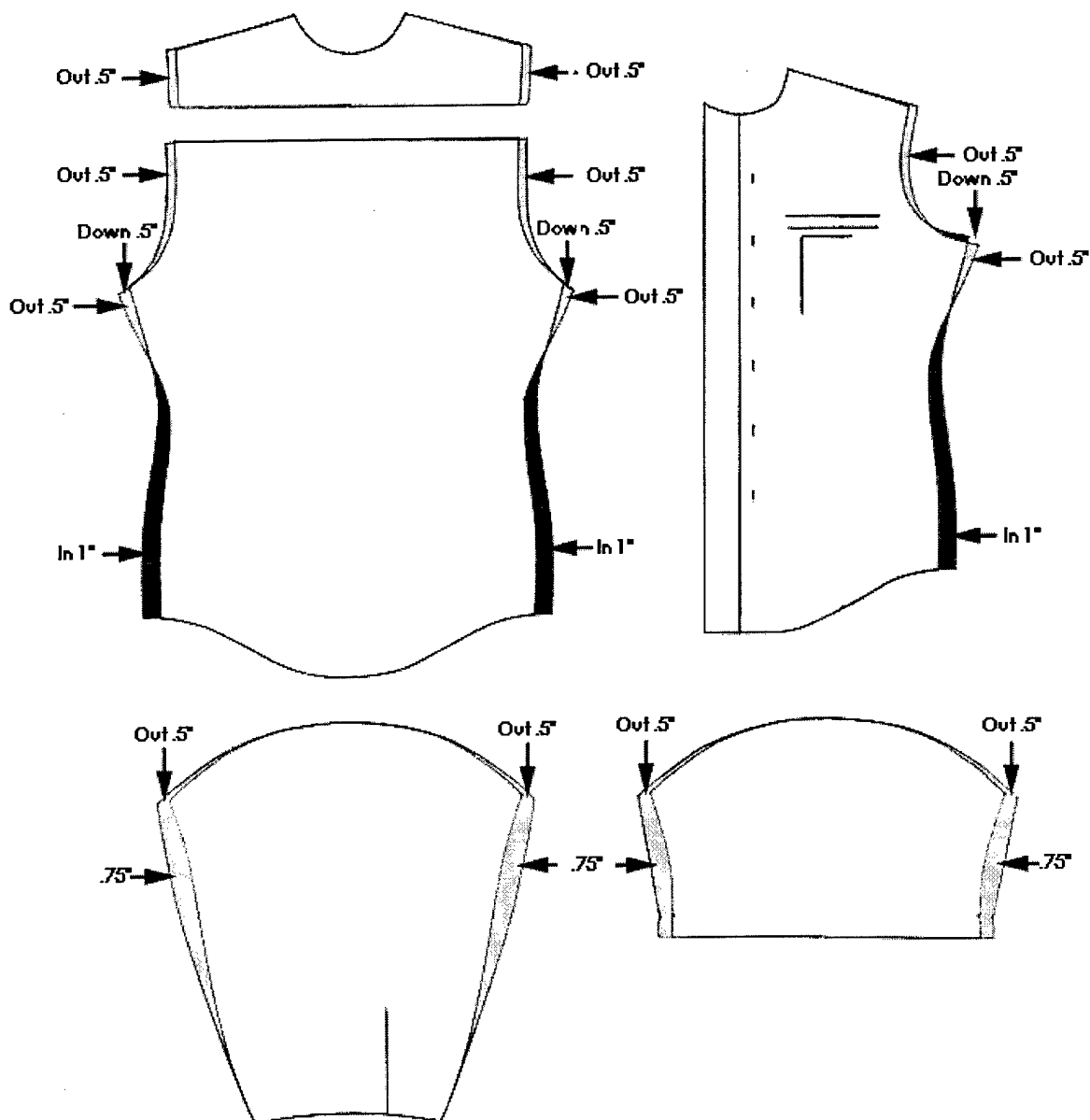


The armcye is shifted $\frac{1}{2}$ inch on each side. The shoulder seam is blended back to the original at the shoulder at neck point. The side seam is blended back to the original at the side seam at hem point.

Men's AG415 Shirt Garment Dimensions
Wide Back

Size	Chest	Waist	Sweep	Cross Back	Biceps	Length
13	38.00	31.50	35.25	16.25	14.50	30.25
13.5	40.00	33.50	37.25	17.00	15.00	30.50
14	42.00	35.50	39.25	17.75	15.50	30.75
14.5	44.00	37.50	41.25	18.50	16.00	31.00
15	46.00	39.50	43.25	19.25	16.50	31.25
15.5	48.00	41.50	45.25	20.00	17.00	31.50
16	50.00	43.50	47.25	20.75	17.50	31.75
16.5	52.00	45.50	49.25	21.50	18.00	32.00
17	54.00	47.50	51.25	22.25	18.50	32.25
17.5	56.00	49.50	53.25	23.00	19.00	32.50
18	58.00	51.50	55.25	23.75	19.50	32.75
18.5	60.00	53.50	57.25	24.50	20.00	33.00
19	62.00	55.50	59.25	25.25	20.50	33.25
19.5	64.00	57.50	61.25	26.00	21.00	33.50
20	66.00	59.50	63.25	26.75	21.50	33.75
20.5	68.00	61.50	65.25	27.50	22.00	34.00
21	70.00	63.50	67.25	28.25	22.50	34.25
21.5	72.00	65.50	69.25	29.00	23.00	34.50
22	74.00	67.50	71.25	29.75	23.50	34.75
22.5	76.00	69.50	73.25	30.50	24.00	35.00
23	78.00	71.50	75.25	31.25	24.50	35.25

AMS_BB and AML_BB

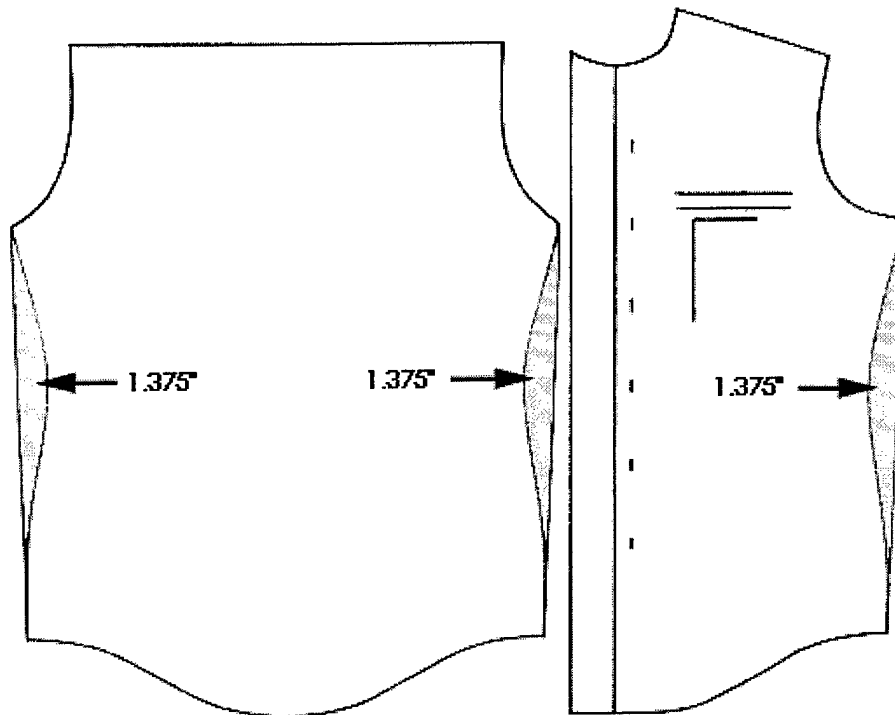


Additions are indicated in yellow; deletions are in red. The armcye is shifted out .5 inch on each side. The shoulder seam is blended back to the original shoulder at neck point. The side seam is blended back to the original at the side seam at hem point. The hemline and waist are shifted in 1 inch. The side seam is blended back to the original armcye at side seam. The armcye is shifted down .5 inch. The armcye is blended back to the original shoulder at armcye. The side seam is blended back to the original side seam at waist. The sleeves are shifted out .5 inch at the cap/undersleeve intersection. The cap is blended back to the original top of cap. The undersleeve seams are blended back to the original wrist in such a way that .75 inch is added at the biceps level.

Men's AG415 Shirt Garment Dimensions
Body Builder

Size	Chest	Waist	Sweep	Cross Back	Biceps	Length
13	40.00	27.50	31.25	16.25	16.00	30.25
13.5	42.00	29.50	33.25	17.00	16.50	30.50
14	44.00	31.50	35.25	17.75	17.00	30.75
14.5	46.00	33.50	37.25	18.50	17.50	31.00
15	48.00	35.50	39.25	19.25	18.00	31.25
15.5	50.00	37.50	41.25	20.00	18.50	31.50
16	52.00	39.50	43.25	20.75	19.00	31.75
16.5	54.00	41.50	45.25	21.50	19.50	32.00
17	56.00	43.50	47.25	22.25	20.00	32.25
17.5	58.00	45.50	49.25	23.00	20.50	32.50
18	60.00	47.50	51.25	23.75	21.00	32.75
18.5	62.00	49.50	53.25	24.50	21.50	33.00
19	64.00	51.50	55.25	25.25	22.00	33.25
19.5	66.00	53.50	57.25	26.00	22.50	33.50
20	68.00	55.50	59.25	26.75	23.00	33.75
20.5	70.00	57.50	61.25	27.50	23.50	34.00
21	72.00	59.50	63.25	28.25	24.00	34.25
21.5	74.00	61.50	65.25	29.00	24.50	34.50
22	76.00	63.50	67.25	29.75	25.00	34.75
22.5	78.00	65.50	69.25	30.50	25.50	35.00
23	80.00	67.50	71.25	31.25	26.00	35.25

AMS_P and AML_P

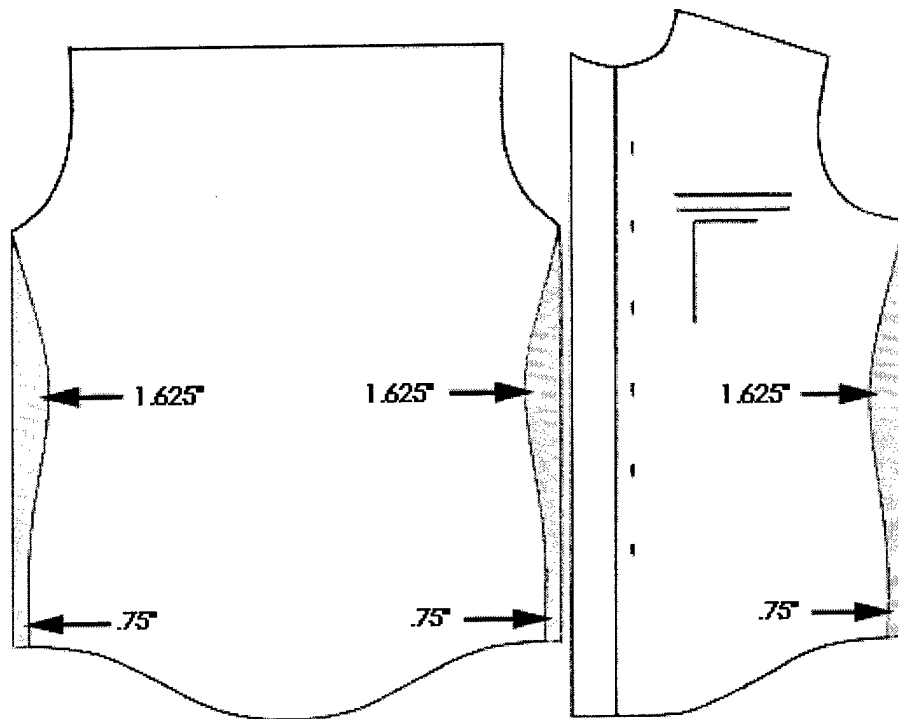


The curve at the waist is removed by replacing the side seam with a straight line connecting the original armcye at side intersection and the original hem at side intersection.

**Men's AG415 Shirt Garment Dimensions
Plus Waist**

Size	Chest	Waist	Sweep	Cross Back	Biceps	Length
13	38.00	37.00	35.25	15.25	14.50	30.25
13.5	40.00	39.00	37.25	16.00	15.00	30.50
14	42.00	41.00	39.25	16.75	15.50	30.75
14.5	44.00	43.00	41.25	17.50	16.00	31.00
15	46.00	45.00	43.25	18.25	16.50	31.25
15.5	48.00	47.00	45.25	19.00	17.00	31.50
16	50.00	49.00	47.25	19.75	17.50	31.75
16.5	52.00	51.00	49.25	20.50	18.00	32.00
17	54.00	53.00	51.25	21.25	18.50	32.25
17.5	56.00	55.00	53.25	22.00	19.00	32.50
18	58.00	57.00	55.25	22.75	19.50	32.75
18.5	60.00	59.00	57.25	23.50	20.00	33.00
19	62.00	61.00	59.25	24.25	20.50	33.25
19.5	64.00	63.00	61.25	25.00	21.00	33.50
20	66.00	65.00	63.25	25.75	21.50	33.75
20.5	68.00	67.00	65.25	26.50	22.00	34.00
21	70.00	69.00	67.25	27.25	22.50	34.25
21.5	72.00	71.00	69.25	28.00	23.00	34.50
22	74.00	73.00	71.25	28.75	23.50	34.75
22.5	76.00	75.00	73.25	29.50	24.00	35.00
23	78.00	77.00	75.25	30.25	24.50	35.25

AMS_X and AML_X



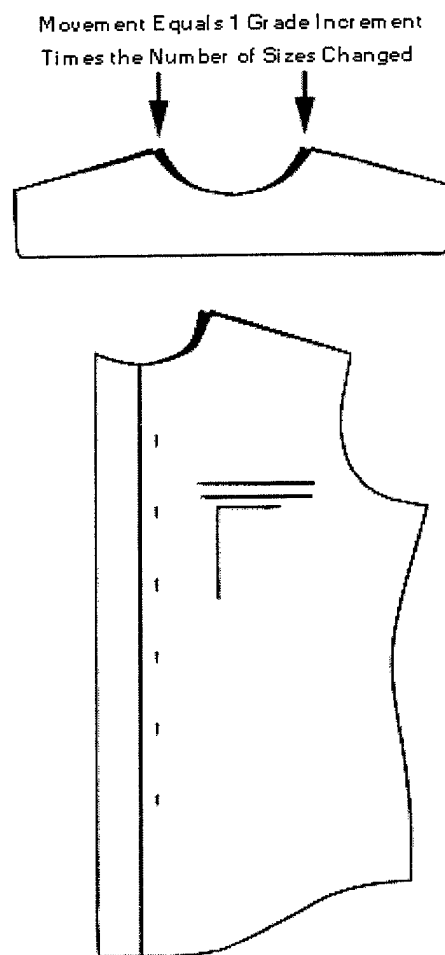
The curve at the waist is removed and additional sweep is added by replacing the side seam with a straight line on grain beginning at the armcye at side seam intersection and ending at the level of the hem.

Men's AG415 Shirt Garment Dimensions
XPlus Waist and Seat

Size	Chest	Waist	Sweep	Cross Back	Biceps	Length
13	38.00	38.00	38.00	15.25	14.50	30.25
13.5	40.00	40.00	40.00	16.00	15.00	30.50
14	42.00	42.00	42.00	16.75	15.50	30.75
14.5	44.00	44.00	44.00	17.50	16.00	31.00
15	46.00	46.00	46.00	18.25	16.50	31.25
15.5	48.00	48.00	48.00	19.00	17.00	31.50
16	50.00	50.00	50.00	19.75	17.50	31.75
16.5	52.00	52.00	52.00	20.50	18.00	32.00
17	54.00	54.00	54.00	21.25	18.50	32.25
17.5	56.00	56.00	56.00	22.00	19.00	32.50
18	58.00	58.00	58.00	22.75	19.50	32.75
18.5	60.00	60.00	60.00	23.50	20.00	33.00
19	62.00	62.00	62.00	24.25	20.50	33.25
19.5	64.00	64.00	64.00	25.00	21.00	33.50
20	66.00	66.00	66.00	25.75	21.50	33.75
20.5	68.00	68.00	68.00	26.50	22.00	34.00
21	70.00	70.00	70.00	27.25	22.50	34.25
21.5	72.00	72.00	72.00	28.00	23.00	34.50
22	74.00	74.00	74.00	28.75	23.50	34.75
22.5	76.00	76.00	76.00	29.50	24.00	35.00
23	78.00	78.00	78.00	30.25	24.50	35.25

AML_N4 and AMS_N4

Illustration is for N4, instructions are generic.



Areas to be deleted are in red.

The grade increment per size is determined. The increment is multiplied by the number of sizes to be changed. The neck/shoulder point is moved by the amount of the total increment and blended to the center front on the garment and the facing. The shoulder/outer edge point of the facing is moved by the same amount.

No measurement chart is provided for this modification. The grade increment for the neck is $\frac{1}{2}$ inch per size. To determine the neck measurement, multiply $\frac{1}{2}$ by the number of neck sizes added. In the above sample the neck size in the standard chart would increase by 4 times $\frac{1}{2}$ inch or 2 inches. Add 2 inches to the neck measurement in the standard chart.

APPENDIX 6: CARGOES USER MANUAL

CARGOES User Guide

INTRODUCTION

PROGRAM DESCRIPTION

CARGOES is an abbreviation for Clemson Apparel Research Garment Order Entry System. Because it is hard to keep capitalizing, it is also simply written as Cargoes. Whichever way it is written, it is a system that has been designed specifically for manufacturers that make special measurement garments for the military.

With Cargoes you can enter orders and measurement data. Cargoes can determine the best-fit size based on measurement data and point out areas where a body measurement is out of range for the size. When it comes time to ship, Cargoes helps build a shipment from completed garments and prints the required DD250 invoice form. Then as payments are received for the shipments, the payments are posted against your invoices so that you can track the status of unpaid invoices.

CARGOES SCREENS



A Cargoes screen is a Window's window. In the upper left of the screen is the icon (symbol or picture) that has been chosen to represent Cargoes. It is a set of crossed rulers signifying the unique special measurement features of Cargoes. To the right of the icon is the title of the screen. The title is sometimes changed to indicate the action being performed or the record that is displayed. In the upper right are two standard window controls. The _ button is the minimize button and works in the standard way. The X button is the close button and if you press it, Cargoes will ask if you wish to exit and end. Press Cancel to return to the current screen. Press No to return to the prior screen (Back). Press Yes to cancel and exit Cargoes.



On most Cargoes screens there is a Back or Exit button on the lower left. It causes Cargoes to go back to the prior screen.

In the main portion of the screen are different types of controls that are used to display data, allow data entry, or specify a command or action. In some cases, Cargoes will change what appears on the screen based on the data and the activity that is taking place.

Command Buttons



Command buttons are used to perform an action, function, or command. Push a button by clicking once with the mouse. In some cases, the button will have an icon or symbol representing the action. In all cases, the button will contain a description of its function. When a letter in the description is underlined, the button can be pressed by pressing the Alt key and the underlined letter in combination. When a button is highlighted by a dark shadow, you can press the Enter key to perform the command.

Database Control



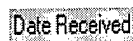
Database controls are a series of arrow buttons. They allow you to change the record you are using, the current record, in the Cargoes database. The left line and arrow button is used to position to the first record. The single left arrow is used to position to the prior record. The single right arrow is used to position to the next record. The right arrow and line is used to position to the last record.

Grid

Invoice	OrderNumber	Quantity	D
97-0001	97	6	
▶ 97-0002Z	97	2	
98-0001	98	1	
98-0002	98	2	
98-0003	98	2	
98-0004	98	2	
98-0005Z	98	2	

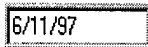
Cargoes uses a grid to display a set of records from the Cargoes database called a table. The rows in the grid are database records. You can use the arrows on the right to change the records that can be viewed. The columns are fields within the records. You can use the arrows on the bottom to change which columns can be viewed. The current record is often indicated by an arrow in a special column on the left and the row may be highlighted. Some screens allow you to change the current record by clicking on a row in the grid.

Labels




Labels are simply text that appear on the screen. They appear most often as descriptions next to other controls.

Entry Field

A rectangular text entry field with a thin border, containing the date "6/11/97".

Entry fields allow for the entry or updating of data. You can select an entry field by clicking within the field or by using the Tab key to move between the fields. Cargoes will change the background of an entry field to yellow when the field is selected. Once the field is selected, a stroke will appear to indicate your current position within the field. You can then use the standard keys for changing or moving within the field.

List Entry Field

A list entry field consisting of a small rectangular box with a downward-pointing arrow on the right side. Below the box, a dropdown menu is open, showing two options: "Male" and "Female".

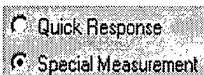
The list entry field allows you to enter a value into a field or select an entry from a list of valid alternatives. To select an entry, click on the down arrow button and then click on the entry you wish to enter.

Check Box

A check box control consisting of a small square box with a checkmark inside, followed by the text "Process All".

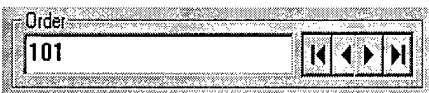
A check box indicates whether a particular condition is on or off. A check in the box indicates that the condition is on. Click in the box to change its value.

Option Button

Two option buttons arranged vertically. Each button consists of a small circle (radio button) followed by text. The top button has an unselected radio button and the text "Quick Response". The bottom button has a selected radio button (filled circle) and the text "Special Measurement".

Option buttons present a set of choices. You can only select one option button in a group of option buttons. To select, click in the button.

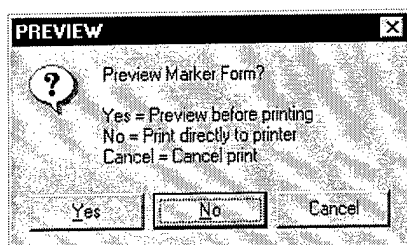
Frame Box

A frame box control. It has a title bar at the top with the text "Order". Below the title bar is a text entry field containing the number "101". To the right of the text field are four small square buttons with arrows: a left arrow, a double left arrow, a double right arrow, and a right arrow.

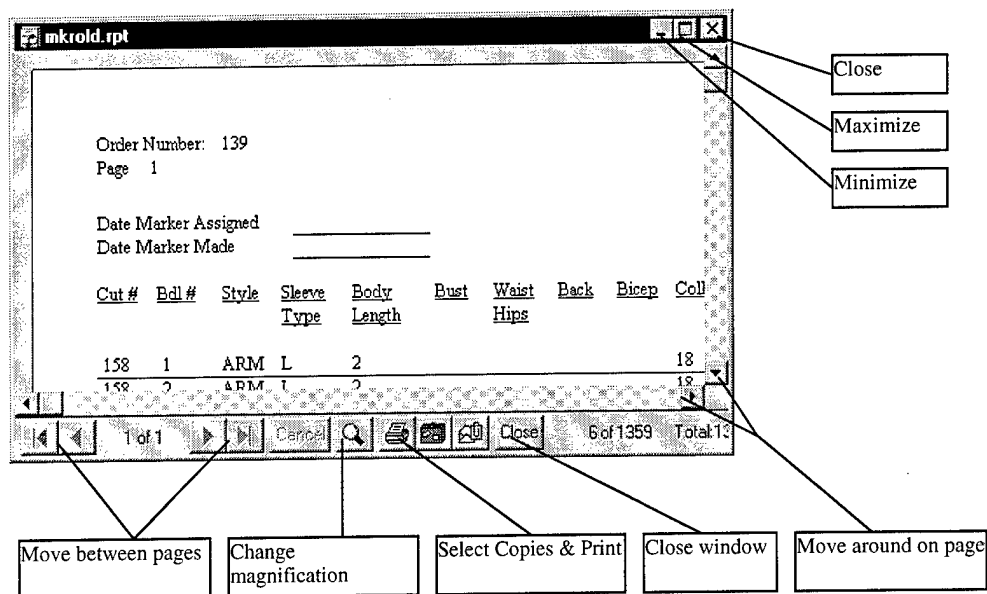
A frame box is simply a box on the screen that is used to group or frame other controls on the screen. The title of the box is in the upper left corner.

PRINT PREVIEW

Almost all of the reports that are produced by Cargoes have a print preview option. Before Cargoes prints the report, it will ask if you wish to preview the report. For example:



To stop the report from printing, press Cancel. To print directly to the printer, press No or ENTER. To preview the report, press Yes. Cargoes will display a print preview window:



If more than one report is printed, each will appear in a separate window. The windows will appear on top of each other but each entry will display in the Windows task bar.

RUNNING CARGOES

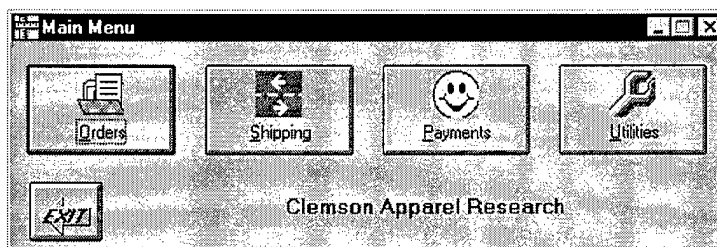
STARTING

There are two ways that you may start Cargoes. The first is from the Windows Start menu. Select Programs and then Cargoes. The other is from a shortcut that may have been placed on your desktop. If this is the case, you can double-click the Cargoes icon.

The first screen you will see is the Cargoes Opening screen which appears on the cover of this guide. Click on the Cargoes button to open the database and go to the Main Menu screen.

MAIN MENU

The Main Menu screen is used to select the main function to be performed.



Orders - Enter or update orders, order line items, measurement, and sizing information.

Shipping - Build shipments and invoices (DD250is) from completed bundles.

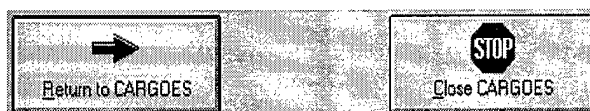
Payments - Post receipt of payments for invoices.

Utilities - Menu of less frequently used functions such as updating DODAAC's.

To select a function, press the corresponding button. To exit Cargoes, press the Exit button.

CLOSING

After pressing the Exit button, the Cargoes closing screen will display. The closing screen is similar to the opening screen except that it contains two buttons:



Press Close to close Cargoes. Press Return if you have exited Cargoes accidentally.

ORDERS

ORDER MENU

The Order Menu on the Orders screen is used to select an order and then the action to be taken on the order. Cargoes displays it after you select Orders on the Main Menu or after completing work on an order.

The screenshot shows a window titled 'Orders' with a table of orders and a control panel below it.

OrderNum	ContractNum	DateDPSC	DateReceived	TimeReceived	DateEntered
143	SP0100-97-M-SD61	6/23/97	6/26/97	11:15:00 AM	7/2/97
144	SP0100-95-D-1002-0221	6/30/97	7/3/97	11:45:30 AM	7/14/97
145	SP0100-97-M-SD83	6/30/97	7/3/97	11:45:21 PM	7/14/97
146	SP0100-97-M-SD66	6/30/97	7/3/97	11:45:11 PM	7/3/97
147	SP0100-97-M-SD85	7/7/97	7/10/97	11:30:00 PM	7/11/97
148	SP0100-95-D-1002-0223	7/11/97	7/14/97	11:30:24 AM	7/14/97
149	SP0100-95-D-1002-0224	7/13/97	7/16/97	11:25:00 AM	7/18/97
150	SP0100-97-M-SE07	7/15/97	7/16/97	11:20:48 PM	7/25/97
151	SP0100-95-D-1002-0227	7/19/97	7/22/97	10:23:34 PM	7/29/97
152	SP0100-95-D-1002-0225	7/22/97	7/25/97	11:40:52 PM	8/14/97
153	SP0100-97-M-SE20	7/26/97	7/29/97	9:40:11 AM	8/1/97
154	SP0100-97-M-SC55	8/1/97	8/4/97	4:11:05 PM	8/11/97
155	SP0100-97-M-SE38	8/2/97	8/5/97	11:30:00 AM	8/13/97
156	SP0100-97-M-SE64	8/9/97	8/12/97	12:30:10 PM	8/14/97
157	SP0100-95-D-1002-0229	8/16/97	8/19/97	10:00:43 AM	8/20/97
158	SP0100-95-D-1002-0230	8/18/97	8/21/97	2:30:34 PM	8/22/97
159	SP0100-95-D-1002	8/24/97	8/27/97	8:25:27 AM	8/27/97
160	SP0100-95-D-1002	8/25/97	8/28/97	11:30:20 AM	8/28/97
161	SP0100-97-M-SE92	8/25/97	8/28/97	11:53:43 AM	8/28/97

Below the table is a control panel. It includes an 'Order' field with the value '161' and navigation arrows. Below this is an 'Actions' frame with buttons for 'Add New', 'Delete', 'Edit', and 'Line Items'. A 'Back' button is also visible on the left.

Existing orders are displayed in a grid at the top of the screen. Below the grid are two frames. The Order frame displays the current order number. It also has some arrows that allow you to move to the first order, prior order, next order, or last order. The Actions frame contains buttons for the different actions that you can perform. The Add New button adds a new order number. The Delete button is for deleting the current order. The Edit button allows updating of the current order.

If you wish to edit or delete an existing order, there are three ways for changing the current order number:

1. Use the grid arrows to move around in the orders and click somewhere on an order's line to select that order.
2. Use the arrows in the Order box to change the order number.
3. Click in the Order field (the arrows will change to a Search button), change the current order number, and press the Enter key or press the Search button. The order number can be entered as the Cargoes order number or as Contract-DeliveryOrder.

ORDER ENTRY

The Order Entry frame on the Orders screen allows you to enter or update information concerning an order. Cargoes displays it after you select a function on the Order Menu screen.

The order box displays the current order number at the top of the screen. If you are adding a new order, it will say "New Order". If you are deleting an order, the fields will be protected and the OK button will be a Delete button.

Below the Order box, there are fields to be entered or updated for the order:

Contract Number - Contract under which the order has been placed. If there is a delivery order, enter as Contract-DeliveryOrder. (Ex. SO0100-97-M-SE91-0301)

DPSC Date - Date order was process by DPSC.

Order Type - Use Special Measurement

Date Received - Date you received the order.

Time Received - Time you received the order.

Days Until Delivery - Army due in 14 days, Air Force due in 21 days - Set by Cargoes.

Date Due - See above - Set by Cargoes.

Default Bill To - Optional bill-to DODAAC for line item entry.

Default Ship To - Optional ship-to DODAAC for line item entry.

After entering or updating the fields, press OK.

If you are adding an order, the order number is generated automatically. You will automatically go to the Order Line Items screen and the order number appears at the top of the Order Line Items screen.

To delete an order, press Ddelete. You will be prompted again as to whether you really want to delete the order. If so, press Yes. You will get confirmation that the order has been deleted.

ORDER LINE ITEMS

The Order Line Items screen is used to select a line item and the action to be taken. Cargoes displays it after you complete the Order Entry screen.

CLIN	Requisition Number	Last Name	First Name	OrderQuantity	ShipQuantity	Sty
1	HX23457189401W	SMITH	BRANDI	3	0	L
2	HX27737229462W	JONES	SABRINA	1	0	S
3	HX27737229404W	JONES	SABRINA	1	0	L

The Order box shows the current order and some information about the order at the top of the screen. Below the Order box, existing order line items are displayed in a grid and can be selected to change the line item. The database control below the grid can also be used to change the current line item.

Below the arrows are buttons for selecting the function to be performed:

Add creates a new order line item.

Delete deletes an existing line item.

Edit edits an existing line item information.

Measurements is for entering the appropriate measurements data.

Sizing is for calculating sizing information. If the Process All check box has not been checked, pressing Sizing goes to the Men's or Women's Sizing screen. If it has been checked, pressing Sizing will calculate sizing information for all lines and you will be given the option of printing the sizing report.

Assign C/B is for assigning cuts and bundles.

Marker Form is for printing marker forms.

LINE ENTRY

The Line Entry frame of the Order Line Item screen is used to enter or edit order line item information. It is displayed after selecting a line item from the Order Line Items screen and clicking on Add, Delete, or Edit.

SM Order Line Entry

CLIN	3	Requisition Number	HX27737229404w
Last Name	JONES	First Name	SABRINA
Quantity	1	Style	Long Sleeve
Price	\$35.00	Sex	Female
YPT Date	97245	Service	Air Force
Bill To	SC1020	Ship To	HX2773

DODAACs OK Cancel

The fields on the Line Item screen are

CLIN - Customer Line Item Number, the sequential number of the line item within the order.

Requisition Number - The requisition number of the line item.

Last Name - The last name of the person requiring the garment.

First Name - The first name of the person requiring the garment.

Quantity - The quantity ordered.

Style - Long Sleeve or Short Sleeve, can be entered as L or S.

Price - The price per unit.

Sex - Male or Female, can be entered as M or S.

YPT Date - The date DPSC received the order from the unit.

Service - Branch of military service. This will be filled in automatically from the DODAAC in the requisition. Can be entered as AR, AF, CG, NA, or MC.

Bill To - Enter the bill-to DODAAC. May be filled in from the order default bill-to.

Ship To - Enter the ship-to DODAAC. May be filled in from the order default ship-to.

Enter information in the fields and then press OK. If you get a DODAAC not found error message, press the DODAAC's button to go to the DODAAC menu to lookup or add a DODAAC.

MEASUREMENTS

The Woman's Measurements and Men's Measurements screens are for entering or editing line item measurement information. Cargoes displays the appropriate screen after Measurements is pressed on the Order Line Items screen.

Men's Measurements

Line Information
CLIN: 1 Name: JONES, MICHAEL Requisition: HX33207204190H

Shoulder Shape
☐ Sloping/Long Neck ☒ Regular/Regular Neck ☐ Square/Medium Neck ☐ High/Short Neck

Posture
☐ Normal ☒ Erect ☐ Forward/Stooped ☐ Half-Stout ☐ Stout ☐ Corpulent

Shirt Measurements

Back Width	10	Bent Sleeve Lth	32	Chest	51.5	Waist	39	Collar Size	19
Bicep	18	Seat	45.5	Sleeve Length	32				

Other Information
Height 5 ft 9 in. Weight 225 lbs.
SSN 291-56-8406 Comments

[Back](#) [OK](#)

The screen is similar to the form sent with the order. Select the appropriate body descriptions, enter the measurement information, and press OK.

SIZING

The Woman's Sizing and Men's Sizing screens are used for calculating size information. Cargoes displays the appropriate screen after Sizing is pressed on the Order Line Items screen.

Men's Sizing

Line Information
CLIN: 1 Name: JONES, MICHAEL Requisition: HX33207204190H

	Measurements	Standard Ranges	Adjusted Ranges	Suggested Size and Modifications
Height	69	(0, 100)		
Waist	39	(44, 49)	(37, 49)	
Back Width	10	(10.5, 10.75)		
Chest	51.5	(49.5, 52.5)		
Seat	45.5	(0, 53)		
Collar	19	(19, 19)		
Sleeve	32	(29, 41)		
Bicep	18	(0, 18.5)		

Actions

The Men's and Women's Sizing screens are similar. The difference is the body dimensions displayed. The buttons at the bottom are used to perform sizing functions:

- Suggest Size - Calculate best-fit sizing calculations. Ranges and suggestions are displayed.
- Clear - Clear sizing suggestions.
- Print - Print a sizing report.
- Manual - Go to Manual Sizing and perform manual sizing.

MANUAL SIZING

The Woman's and Men's Manual Modification Entry screens are used for entering manual sizing information. Cargoes displays the appropriate screen after Manual is pressed on the Sizing screen.

Men's Manual Modification Entry

CLIN: 1 SizeCode: 489 Name: JONES, MICHAEL

Length

Waist/Hips

Back

Collar/Size

Body/Proportion

Sleeve

Bicep

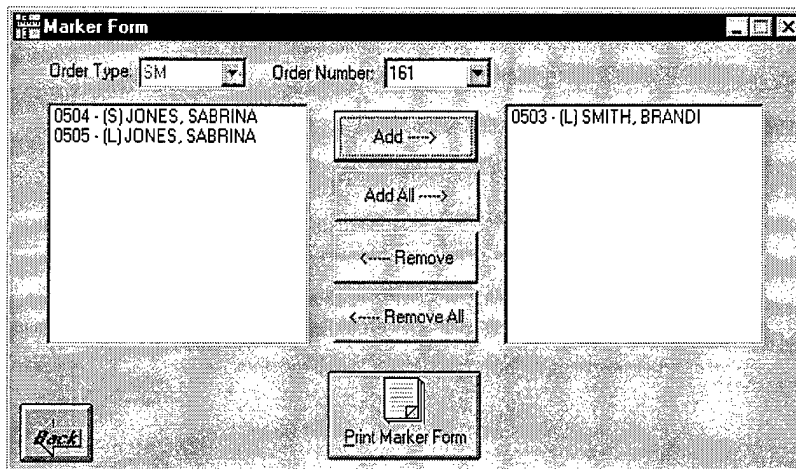
Comments

Back OK

The Men's and Women's Manual Sizing screens are similar. The difference is the body dimensions displayed. Enter the measurements and press OK.

MARKER FORM

The Marker Form is used to select the line items for printing and then printing marker forms. Cargoes displays it after Marker Form is pressed on the Order Line Items screen or the Utilities Menu.



You can select a different order type and order number from list boxes at the top of the screen.

On the left is a list box containing line items to select from. On the right is a list box containing line items selected. The buttons in the middle are used to changes these lists:

Add - Move one line item from the left to the right. Click on the line item on the left before pressing Add.

Add All - Move all line items from the left to the right.

Remove - Move one line item from the right to the left. Click on the line item on the right before pressing Remove.

Remove All - Move all lines from the right to the left.

When you have all of the line items on the right that you would like to print, press Print Marker Form. Cargoes will prompt you to see if you wish to preview the marker form. (See Print Preview in the Introduction section).

SHIPPING

SHIP SHIRTS PROCESS

The Ship Shirts Process screen is used to select ranges of cuts and bundles for shipping. Cargoes displays it after Shipping is pressed on the Main Menu screen.

Ship Shirts Process

Cut-Bundle: Through

To Process

CutNum	BdlNum	CARNum	LastName	FirstName	ShipDODAAC	ContractNum	ShirtPrice	Style	S
201	1	497	JONES	FRANK	HX3720	SP0100-95-D-1002-0230	0	L	5
201	2	497	JONES	FRANK	HX3720	SP0100-95-D-1002-0230	0	L	5
201	3	495	SMITH	GREG	WC1MXK	SP0100-95-D-1002-0230	0	L	5

Total: 3

To Ship (Print)

CutNum	BdlNum	CARNum	LastName	FirstName	ShipDODAAC	ContractNum	ShirtPrice	Style	S
200	1	490	JEFFRIES	JOANNE	HX3310	SP0100-95-D-1002-0229	0	S	4
200	2	490	JEFFRIES	JOANNE	HX3310	SP0100-95-D-1002-0229	0	S	4

Total: 2

Actions:

There are two grids on the screen. The top grid displays Cut-Bundles that have been selected to ship. To select a bundle, enter the cut-bundle in the Cut-Bundle field. For example, to enter cut 26 bundle 1, you would enter 26-1. To enter a range of bundles, enter cut-starting~bundle in the Cut-Bundle field and enter ending~bundle in the Through field. For example, to enter cut 38 bundles 1 through 6 enter 38-1 Through 6. Press A to add the bundles to the selected bundles. If you wish to remove a bundle from being selected for shipment, click on the bundle in the grid and then press R to remove it.

When you have entered all the bundles to ship, press the P button. The first bundle in the selected bundle grid and all bundles that are for the same order and to the same DODAAC will be moved to the process grid. Press P to create an invoice and print the DD0250. Cargoes will ask if you wish to preview the DD250 and optional letter. The invoice number will be the order number, a dash, the invoice sequence for that order, and lastly a "Z" if it is the last invoice for the order. (Ex. 156-003Z)

Repeat the Process-Print cycle until all selected bundles have been completed.

Press the D button to go to the Shipment and Payment Display screen. Press the R to reprint a DD0250.

SHIPMENT AND PAYMENT DISPLAY

The Shipment and Payment Display screen displays a variety of shipment and payment information in four grids. Cargoes displays it after Display is pressed on the Ship Shirts Process screen or Display Pmt is pressed on the Payment Processing screen.

The screenshot shows a window titled "Shipment and Payment Display". At the top, there are two summary fields: "Total charge : 25.10" and "Received Amount : 174.00". Below these are four data grids and a "Back" button at the bottom left.

Grid 1 (Top Left): A table with columns: Invoice, OrderNumber, Quantity, D. It contains the following data:

Invoice	OrderNumber	Quantity	D.
79-0001	79	2	
80-0001	80	6	
80-0002	80	13	
80-0003Z	80	1	
81-0001Z	81	6	
82-0001	82	4	
82-0002	82	2	

Below this grid is an "Invoice" field with the value "80-0001" and navigation buttons.

Grid 2 (Top Right): A table with columns: PayNo, Invoice, PayReceivedDate. It contains the following data:

PayNo	Invoice	PayReceivedDate
25	80-0001	1/29/97

Below this grid is a "Record" field showing "1 of 1 in Payments" with navigation buttons.

Grid 3 (Bottom Left): A table with columns: Invoice, BdlNum, CARNum, ContractNum. It is currently empty.

Below this grid is a "Record" field showing "0 of 0 in Ship Items" with navigation buttons.

Grid 4 (Bottom Right): A table with columns: PayNo, CARNum, Amount. It contains the following data:

PayNo	CARNum	Amount
25	44	58
25	45	58
25	46	58

Below this grid is a "Record" field showing "3 of 1 in Partial Pay" with navigation buttons.

To select an invoice, click on the invoice row in the first grid or use the database control. The other grids will be changed to reflect the invoice selected.

REPRINT DD250

The Reprint DD250 screen is used to reprint a previously processed DD250 invoice. Cargoes displays it when Reprint is pressed on the Ship Shirts Process screen.

The screenshot shows a window titled "Reprint DD250". Inside, there is a message: "To print the DD250 form, please double click the record in Invoice Table". Below this is a table with the following data:

Invoice	OrderNumber	Quantity	DateShipped	Freight
156-0002	156	2	8/19/97	
156-0003Z	156	6	8/19/97	
157-0001	157	2	8/26/97	
157-0002	157	4	8/26/97	
157-0003	157	2	8/26/97	
157-0004	157	3	8/26/97	

Below the first table is a record navigation bar: "Record" with left and right arrows, a text box containing "224", and "of 224 in Invoice".

Below this is a second table with the following data:

Invoice	ShipQuantity	CARNum	OrderNum	CLIN	RegNum
157-0004	2	489	157	6	HX373072
157-0004	1	488	157	5	HX373072

Below the second table is another record navigation bar: "Record" with left and right arrows, a text box containing "1", and "of 2 in Ship Items for Invoice".

At the bottom left of the window is a "Back" button.

To reprint a DD250, first select an invoice by using the grid at the top of the screen or by using the database control below it to position the invoice in the grid. If you selecting the invoice as the current record, the items shipped on the invoice will appear in the second grid.

To print the DD250 form, double-click on the invoice row in the first grid. Cargoes will ask if you wish to preview. (See Print Preview in the Introduction section.)

PAYMENTS

PAYMENT PROCESSING

The Payment Processing screen is used to enter or update payment information. Cargoes displays it after Payments is pressed on the Main Menu screen.

Invoice	Amount	Freight	Shipped	To	Confirm#	Paid
157-0004	0	0	8/26/97	HX3730	0	0

CLIN	ReqNum	Qty	Price	Cost	Sex	LastName	FirstName	CARNum
5	HX37307209H190	1	0	0	Male	BLESIADA	MICHAEL	488
6	HX37307210H070	2	0	0	Male	BLESIADA	MICHAEL	489

Select an invoice for processing by enter the invoice number in the Input Invoice # field. Enter payment information in the Payment Check Information box and press OK. Press Cancel to cancel what you have entered if the payment amount is less than the invoice amount, Cargoes will automatically go to the Partial Payments screen.

To display invoices and payments, press the Display Pmt button. Cargoes will display the Shipping and Payment screen described in the section on shipping.

To delete a payment, press the Delete Pmt button and follow the instructions.

The Tracking Date button is under construction.

PARTIAL PAYMENTS

The Partial Payments screen is used to select the line items and amounts covered by a partial payment. Cargoes displays this screen automatically when a partial payment has been posted.

The screenshot shows a window titled "Partial Payment". At the top, there is a "Select" button, a "Net Amount" input field containing "32", and "OK", "Cancel", and "Finish" buttons. Below this is a grid with the following data:

Invoice	CARNum	Qty	CLIN	ReqNum	Cost	Sex
156-0003Z	480	2	6	HX46257210460W	64	Female
156-0003Z	479	2	5	HX46257212460W	64	Female

Below the grid, it says "Total: 2". At the bottom of the window, there is a "Back" button.

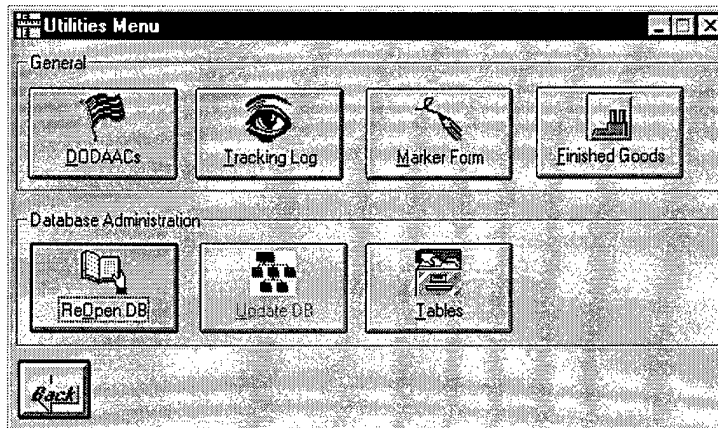
Select a line item in the first grid by clicking on the line and then pressing the Select button. Enter the Net Amount to be posted for the line item and press OK. The posting will appear in the second grid.

Repeat this process until the partial payment has been posted and then press the Finish button.

UTILITIES

UTILITIES MENU

The Utilities Menu is used to group infrequently accessed screens. Cargoes displays it when Utilities is pressed on the Main Menu screen.



DODAAC - Enter or update DODAAC's.

Tracking Log - Enter tracking log entries. Under construction.

Marker Form - Print marker form. (See Orders section.)

Finished Goods - Under construction.


Database Administration - For technical support.

DODAAC's

DODAAC Menu

The DODAAC Menu on the DODAAC screen is used to select a DODAAC and then the action to be taken on the DODAAC. Cargoes displays it after selecting DODAAC from the Utilities Menu.

DODAAC	Address1	Address2	Address3	City	State	Pc
FB6121	126 LS-LGS	BUILDING 23	6356 N NEWHAL RI	O'HARE IAP ARS	IL	80
FB6461	ACCTG DISB STA N	DAD-DE LANGLEY	45 NEALY AVEM ST	LANGLEY AFB	VA	25
HX2106	BARKSDALE AFMC	AAFES ALAMO EXC	BUILDING 4344	BARKSDALE AFB	LA	71
HX2117	DYESS AFMCSS	AAFES RED RIVER	349 3RD AVENUE	DYESS AFB	TX	75
HX2142	HOLLOMAN AFMCS	AAFES DESERT MC	BLDG 787 DRAWER	HOLLOMAN AFB	NM	86
HX2148	LACKLAND AFMCS	AAFES RED RIVER	BUILDING 6659 152	LACKLAND AFB	TX	78
HX2159	RANDOLPH AFMCS	AAFES ALAMO EXC	BLDG 200 A STREE	RANDOLPH AFB	TX	78
HX2163	SHEPPARD AFMCS	AAFES	BUILDING 649 AVEN	SHEPPARD AFB	TX	78
HX2166	Tinker AFMCSS	AAFES Central Plain	Bldg. 475 7280 2nd	Tinker AFB	OK	73
HX2306	Eglin AFMCSS	AAFES Southeast E	Building 19D Dayton	Eglin AFB	FL	32
HX2337	COLUMBUS AFMCS	AAFES	BUILDING 160	COLUMBUS AFB	MS	39
HX2339	MACDILL AFMCSS	AAFES SOUTHEAS	BUILDING 38 HILLS	MACDILL AFB	FL	33
HX2342	MAXWELL AFMCSS	AAFES	BUILDING 851 WRI	MAXWELL AFB	AL	36
HX2345	MOODY AFMCSS	AAFES SOUTHEAS	BUILDING 904 GEO	MOODY AFB	GA	31
HX2351	PATRICK AFMCSS	AAFES SOUTHEAS	BLDG 415 4TH AND	PATRICK AFB	FL	32
HX2352	Homestead Mcss	AAFES	Bldg 344 Elmendorf	Homestead AFB	FL	33
HX2363	SHAW AFMCSS	AAFES SOUTHEAS	BLDG 1422 SHAW	SHAW AFB	SC	29
HX2366	TYNDELL AFMCSS	TYNDELL AFB EXCI	BLDG 1506	TYNDELL AFB	FL	32
HX2405	ANDREWS AFMCS	AAFES NORTHEAS	BLDG 1673 D STRE	ANDREWS AFB	MO	20
HX2408	BOLLING AFMCSS	AAFES CAPITOL EX	BLDG P-12 BOLLING	WASHINGTON	DC	20
HX2413	PENTAGON TTRI S	AAFES ATLANTIC C	DEPT AF PENTAG	WASHINGTON	DC	20

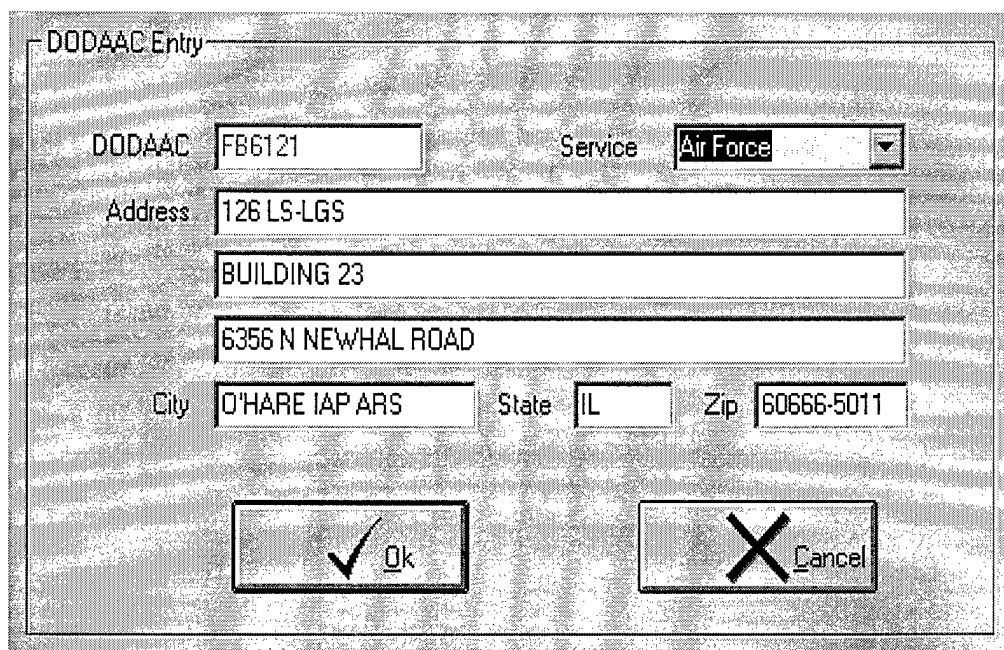

DODAAC:

Actions:

The DODAAC Menu screen is very similar to the Orders Menu screen. To learn how it functions, read the section on the Order Menu screen replacing order or order number with DODAAC.

DODAAC Entry

The DODAAC Entry frame on the DODAAC's screen allows you to enter or update information concerning the order. Cargoes displays it after you select a function on the DODAAC's screen.



The screenshot shows a window titled "DODAAC Entry". Inside the window, there are several input fields and two buttons. The fields are labeled as follows: "DODAAC" with the value "FB6121", "Service" with a dropdown menu showing "Air Force", "Address" with the value "126 LS-LGS", "BUILDING 23", and "6356 N NEWHAL ROAD", "City" with the value "O'HARE IAP ARS", "State" with the value "IL", and "Zip" with the value "60666-5011". At the bottom of the window, there are two buttons: one with a checkmark and the label "Ok", and another with an 'X' and the label "Cancel".

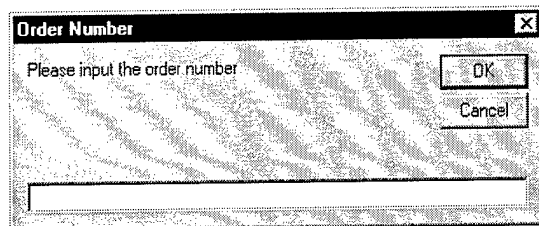
The DODAAC is the first field on the screen. It is protected except when you are adding a new DODAAC. The fields are self-explanatory. If you are deleting a DODAAC, all the fields will be protected and the OK button will be a Delete button.

After entering or updating the fields, press OK. Cargoes will update the record. Press Back to return to the DODAAC Menu screen.

To delete a DODAAC, press Delete.

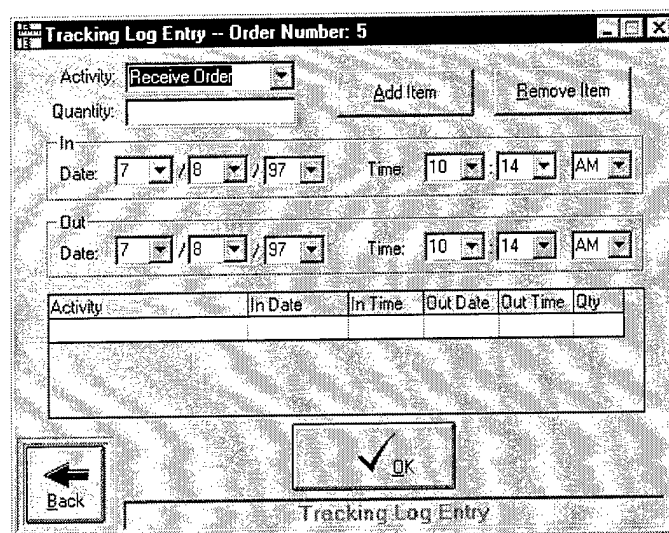
TRACKING LOG

After pressing Tracking Log on the Utilities Menu, Cargoes will prompt for an order number.



A small dialog box titled "Order Number" with a close button (X) in the top right corner. The text inside says "Please input the order number". There is a text input field at the bottom. To the right of the input field are two buttons: "OK" and "Cancel".

After you enter the number, Cargoes will display the Tracking Log Entry screen.



A screenshot of the "Tracking Log Entry -- Order Number: 5" screen. The title bar shows the window name and standard window controls. The screen contains the following elements:

- Activity:** A dropdown menu currently showing "Receive Order".
- Quantity:** A text input field.
- Add Item:** A button.
- Remove Item:** A button.
- In Date:** A date picker showing 7/8/97.
- In Time:** A time picker showing 10:14 AM.
- Out Date:** A date picker showing 7/8/97.
- Out Time:** A time picker showing 10:14 AM.
- Grid:** A table with columns: Activity, In Date, In Time, Out Date, Out Time, Qty. It currently contains one empty row.
- Navigation:** A "Back" button with a left arrow and an "OK" button with a checkmark.
- Footer:** The text "Tracking Log Entry" is displayed at the bottom.

The order number is displayed in the screen title. For each activity that you wish to add, select the Activity, Quantity, the In and Out Date and Times and press Add Item. The item will be added to the grid.

To remove an item, click on the item in the grid and press Remove Item.

To add all items in the grid to the database, press OK.

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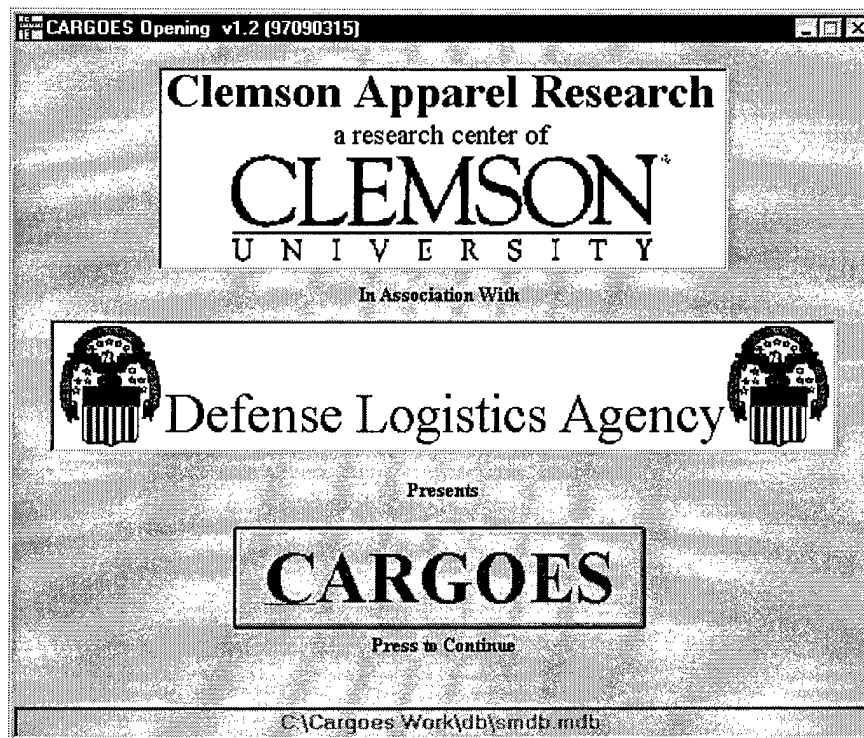
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CARGOES

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September 3, 1997

APPENDIX 7: ACRONYMS AND ABBREVIATIONS

AF 1550: The current fabric, a medium blue, used in the dress shirts for Air Force airmen and airwomen
AFB: Air Force Base
AG 415: The current fabric, a medium green, used in the dress shirts for Army soldiers
ARN: Apparel Research Network
CAR: Clemson Apparel Research (part of Clemson University)
CARGOES: Clemson Apparel Research Government Order Entry System
CIIP: Clothing Initial Issue Point
DFAS: Defense Finance and Accounting System
DD250: Government combination packing list and invoice for clothing
DPSC: Defense Personnel Support Center
DLA: Defense Logistics Agency
FedEx: Federal Express
JROTC: Junior Reserve Officers' Training Corps (high school program)
MCSS: Military Clothing Sales Store
NSN: National Stock Number
RIC: Recruit Induction Center
RTC: Recruit Training Center
UPS: United Parcel Service